Pit and Quarry

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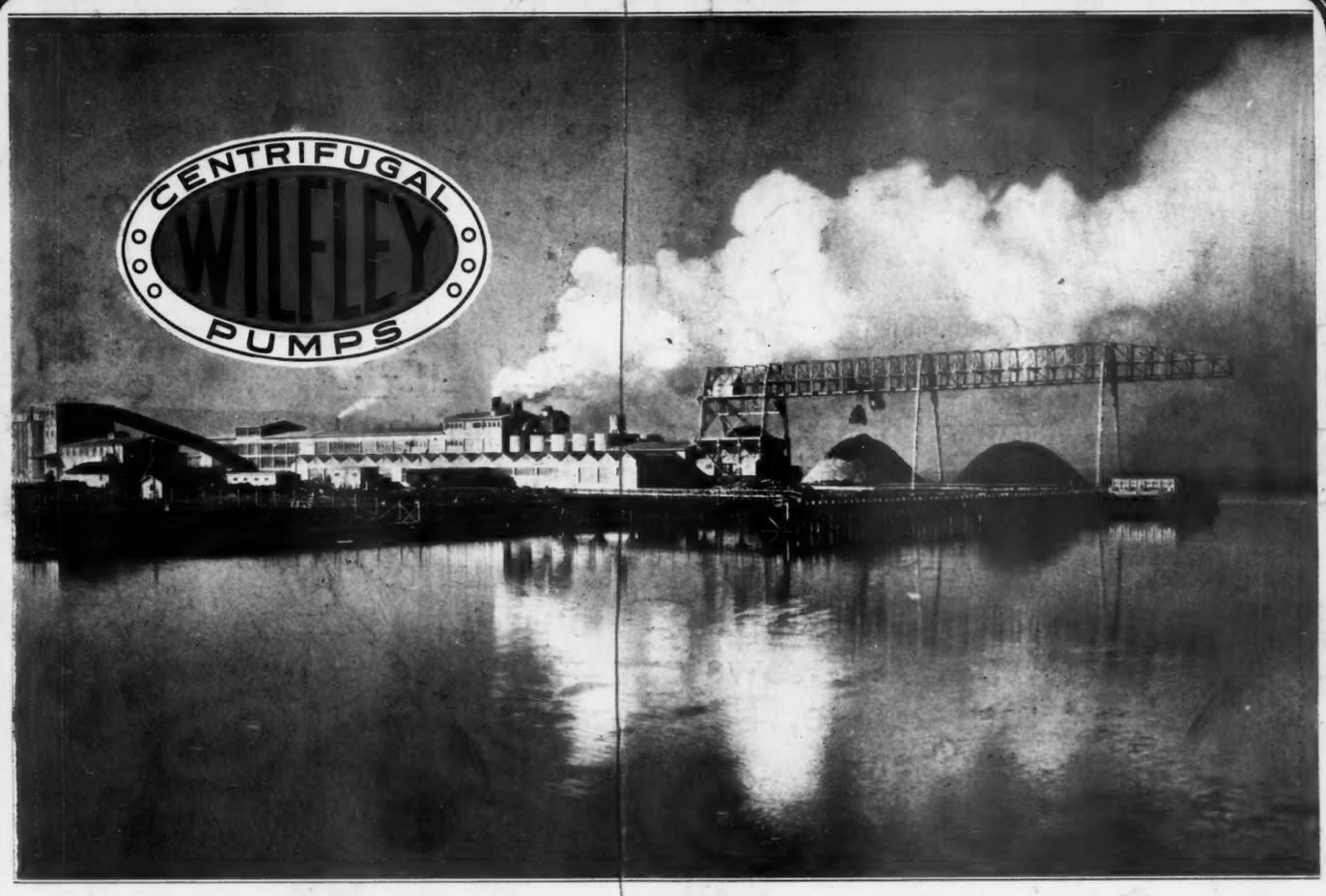
CEMENT-LIME-GYPSUM



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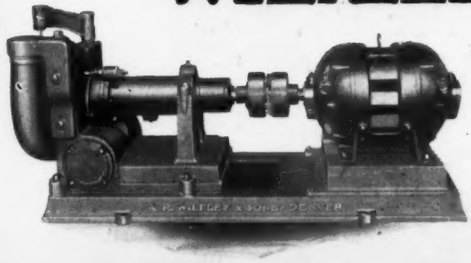

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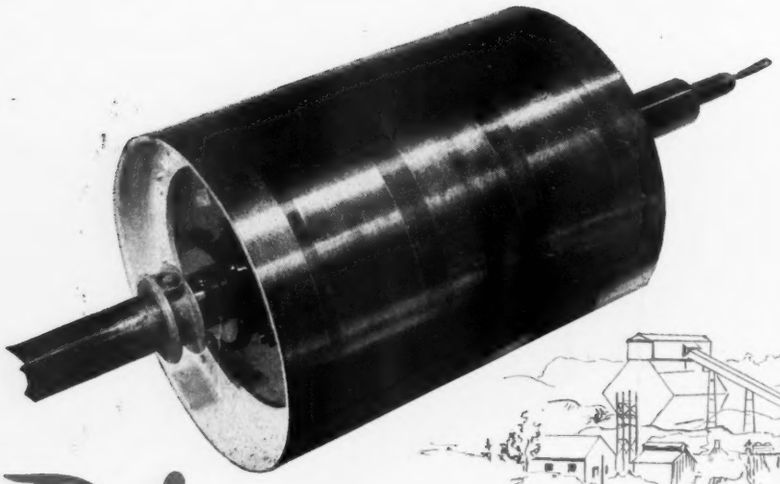

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Pit and Quarry

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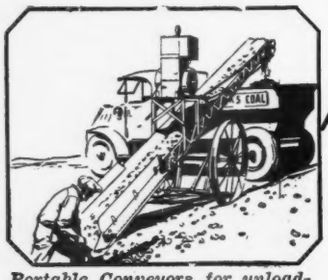

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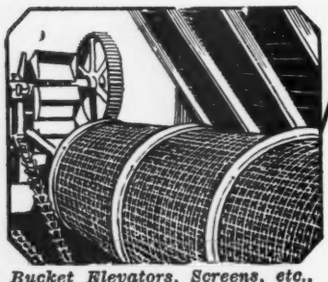

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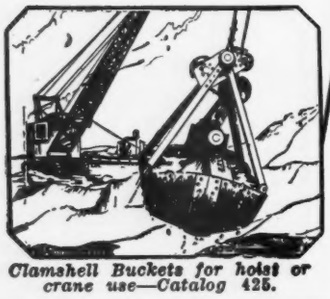

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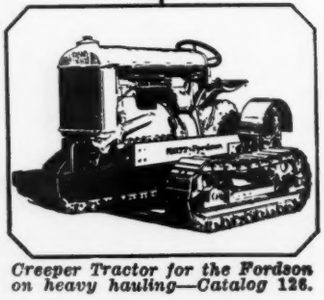

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Pit and Quarry

Vol. 14 CHICAGO, ILL., SEPTEMBER 28, 1927 No. 13

PROFIT OF COOPERATION

WHETHER we recognize it or not, we are rapidly drifting from competition. There is no concerted plan except for a few who are far sighted enough to steer their own operations, as much as they can, in the current in which we are all being carried along.

The old problem of "how to keep on operating when competitors are making price concessions to secure business" is rapidly disappearing. Producers today go into the market maintaining a price that will afford a profit to the vast majority. The competition is usually a matter of quick, careful and thorough service. The fact that the operator assures himself a profit through cooperation should by no means lessen his desire for further profits which may be had by cutting costs of production. Most operators can see the profits of cooperation but fail to see the profits of competition which can be had by competing in the economies of production. The two, however, will bring greater profits. Trade associations, cost figures, modern improved methods of production, publicity of problems, methods and their solution have all helped.

Of these factors, publicity has contributed a great deal. This is the age of publicity. Trade and manufacturing secrets belong to the past. Today we have our associations where recommendations as to the best and most economical methods of operations are discussed. The old problem has been replaced by a new one. Now it is a question of keeping pace with progress. Producers owe it to themselves and to the industry in which they are engaged to join these associations and support them wherever possible.

The great danger to cooperation lies in its abuse and consequent government interference. There are producers who cannot restrain themselves from running up prices as far as the traffic will permit without a thought of the future. It is a policy to "get while the getting is good." The consumer stands for a certain amount of extortion and then he yells for restrictions. Government restrictions usually cost out of all proportion to the benefits gained. Whether restrictions on prices can be controlled effectively by trade association under existing laws is a question. If they can be maintained at a reasonable rate the advantage will be great, otherwise the consumer who constitutes a group constantly increasing in size and power will appeal to the lawmakers. These lawmakers having due respect for the size of this group of consumers will enact laws for price control.

MACHINES FOR REDUCING LABOR TURNOVER

ONE of the greatest problems confronting the management of any plant is that of creating the desire to work. If every management would accomplish that one thing—create the desire on the part of their employees to work—their turnover would be lowered to the irreducible minimum and a great deal of money, time and effort could be expended on other and more fruitful ends.

In considering the creation of the desire for work we find three subconscious elements that effect such a desire. These elements are: ventilation, light and noise. Without proper ventilation, physical endurance is cut down, which condition is reflected on the production charts. Light is an equally important factor in determining the productivity of human labor. Noise is a third element that subconsciously cuts down the efficiency of the workman, effecting both his own and his company's earning capacity. The betterment of any one of all of these three elements will do much toward bringing production to its maximum.

Consciously, workmen demand six major things, the absence of any one of which will materially contribute to labor turnover. The six elements are: fair wages, harmonious surroundings, security of position, possibility for advancement, scope for self-expression and inspiring leadership. It will be readily recognized that in all save the last named, the application of machinery will have a far reaching effect.

To the end of illustration we will take the experience of a manufacturer of automatic telephones. Practically all the workmen in this plant operate on a "quota basis." That is, each man is given a stipulated amount of work to do in a given period. His production over and above that amount warrants

him increased compensation. Hence it is, the interest of the workman lies in how much he can produce over and beyond a certain amount, for he knows such "over-production" will bring him a high unit rate of compensation.

For several months the punch press operators had been grumbling because they found it impossible to get into the "extra money." This condition continued until the labor turnover in that department became alarmingly high and was beginning to effect the morale of other departments. In the analysis of existing conditions made by the management the trouble was found to be in the type of power transmission employed. A change was made, with the result that not only production increased 15 per cent but the men were in a position to produce more than their established quotas and do what they termed "get into the extra money."

Here we find two elements—"fair wages" and "scope for self-expression" brought to the workmen by means of a change in mechanical equipment. With the possibility for faster work and "self-expression" came "security of position" and "possibility for advancement." There remained only the sixth element: "inspiring leadership."

Supplanting human labor through the introduction of machines is a step that invariably brings both immediate and lasting returns. Certain equipment effects the three subconscious elements of light, ventilation and noise. Practically all mechanical equipment will do something toward bettering five of the six conscious elements. The sixth, that of inspiring leadership, depends entirely upon individual ability. The other five (or eight) merely upon the will of acceptance.

WHAT OF THE SPIRIT OF YOUR ORGANIZATION?

EMPLOYERS are coming more and more to realize that the spirit of the organization is a subtle and important factor for success. The most competent workman becomes a far better workman when he works with enthusiasm and loyalty. Employers are to a large degree dependent upon the efforts of the workers; efforts that cannot be secured with a maximum efficiency by force. This fact has led wise employers to establish the custom of holding conferences with their employees. Heads of departments, foremen, minor subordinates are brought together for discussion of problems pertaining to the policies of the organization. Their achievements and efforts are thus commented upon; their suggestions are heard; many a difficulty is ironed out before it has grown to any proportions that might result in unpleasant results. The best expression that we have borrowed from the French is "Esprit de Corps." The Spirit of the organization is the key to its success.

In some cases these conferences have been called "Round Table" discussions. The expression, borrowed from the well known King Arthur stories, is significant. At a round table there is no head; there is no opportunity for indicating rank. All are the same distance from the center; all are for the time equal and can be heard. The effect of such democratic exchange of ideas is so important in establishing a feeling of cooperation and good will that the results are certain to show in numerous and practical ways.

There is a possibility that out of such meetings may come suggestions of inestimable value to the employer. There are many cases which might be cited of suggestions, inventions, ideas that are valuable and practicable that have come from the men in the ranks. The minor executives are nearer to the body of employees than are the executives; very frequently they have their confidence and gain from them information that is important to the manager or owner. Employers cannot be too well informed regarding their business; they cannot have too great harmony and good will. The employer who is indifferent to the opinions of any member of his organization, who is sufficient unto himself, is almost certain to lose much that might be of value to him. True, he will never know that he has missed it, and hence cannot estimate his loss.

A spirit of loyalty permeating through an organization is likely to increase the profits of that organization. A satisfied and enthusiastic person is a far better worker than a moody, disloyal individual. If the employer has the confidence of his minor executives and they in turn have the confidence of the rank and file of employees, it is almost impossible for any force to disrupt the organization. And such employees will increase the earnings of the business. A foreman is more likely to bridge the gap between himself and the lowliest worker if the gap between himself and his superior has been bridged. Ability to give orders or to maintain discipline through sheer force is not the test of an executive. Getting results is the crucial test, and getting results is usually voiced in terms of dollars and cents. Each day's output is the measure of the business. Workers who feel a certain interest in the organization for which they work will turn out enough more work in a day to warrant any effort on the part of the executives to instill in the employees this feeling that their employer's interest is their interest; that they can express opinions and be heard; that a stable relation of friendship exists between them and their superiors. Thus with the removal of all friction a business is certain to expand to the satisfaction of all who are a part of it. In the course of a year with this spirit of cooperation the stockholders will have occasion to wonder what has happened.

EXCELLENT PROGRESSIVE CEMENT UNIT FOUND IN MONOLITH PORTLAND CEMENT COMPANY

By Gordon F. Sondraker

THE Monolith Portland Cement Company, whose plant is located at Monolith, California, approximately one hundred and twenty miles north of Los Angeles, have proven themselves very progressive. The company first started operation in April, 1920, by taking over the old plant erected by the City of Los Angeles for the purpose of furnishing cement for the aqueduct constructed by the city for the purpose of bringing water from the Owens Valley to Los Angeles, a distance of some two hundred and fifty miles.

At that time, the production was one thousand barrels per day dry process. The daily production was raised to three thousand barrels in 1923 and again to four thousand barrels in 1924. In September, 1924, the mill was changed to wet process to insure a more uniform high quality. No one can question the ability and the progressiveness of the operating personnel when the daily capacity of the plant has been increased four hundred per cent in seven years.

The Monolith Portland Cement Company manufactures a high grade standard cement and a plastic waterproof cement. This last is manufactured under Olsen patents. They have met with excellent market reception for this product. Quality has always been the watchword and every step has been taken to assure a uniform high quality cement, both standard and plastic.

Lime Rock Quarry

The company is fortunate in having an excellent quarry of high grade lime rock located about three miles distant from the plant. This rock analysis 92 per cent calcium carbonate across the face of the quarry and has a very low iron, magnesia and silica content. The overburden on the quarry is negligible.

Periodically large "shots" are put off in the quarry, using both "coyote" holes and well holes as a means of placing the explosives. This results in an immense tonnage of rock of fairly uniform size being placed on the quarry floor. All material too large for handling is broken up by means of "dobe" shots. One of the accompanying illustrations depicts a large shot recently put off at the quarry. Hercules explosives and Cordean Bickford fuse are used.

Narrow gauge railroad tracks are laid on the quarry floor as close to the broken floor as possible and the rock is loaded into 5½-ton capacity Koppel side-dump cars by means of three steam shovels, two Eries' and one Marion all equipped with ½-yard dippers and all equipped with caterpillar tracks.

Three Plymouth gasoline locomotives are used for hauling the cars from the quarry floor to the crushers. Two of the locomotives are rated at seven tons and the third is rated at twelve tons. One of the seven ton locomotives and the twelve ton locomotive are gear driven and the other seven ton engine is friction drive. According to the quarry foreman, the gear driven locomotives have proven more efficient. Thirty-two Koppel 5½-ton side-dump cars are in service.

A complete blacksmith shop is maintained at the quarry to take care of any necessary repairs and to sharpen drill steel. A Sullivan class W. J. 3, size 14x8¾x10 compressor is used to furnish air for drilling operations and in the blacksmith shop. A Wayne water softener Type S 1-36 is used to soften the water for the boilers on the steam

Plant of the Monolith Portland Cement Company

View During Construction Taken Earlier Than View on Page 39

shovels. The quarry is operated in two eight hour shifts.

Crushers at Lime Quarry

The track is so laid that the rock is brought in and dumped in a reinforced concrete bin of two car capacity which is immediately over an oscillating grizzly. The rock is fed from the bin on the grizzly by gravity. The grizzly is driven by a General Electric 40 h.p. motor direct connected through a number D-50-20 Foote gear reducer. The Koppel cars are usually dumped by hand but in the event that the load is so distributed as to make this difficult, an overhead Northern Electric hoist is called into use.

The oscillating grizzly feeds the rock to a 48 by 60 inch Traylor Bulldog jaw crusher which crushes material from four feet to approximately eight inches when discharged. This crusher is driven by an Allis Chalmers special high torque motor, having 570 r.p.m. and operating on 440 volts. An 18 inch rubber composition belt transmits power to an eight foot pulley connected with the crusher. From the Traylor jaw crusher the material is elevated to a bin by means of a steel bucket elevator running at a 45 degree angle in steel tracks. Immediately below this bin a 48 inch Williams mill is located which is used as a secondary crusher and reduces the material from eight inches to one inch.

The material is then elevated to a rotary screen which scalps all the dust from the Williams mill product, this operation insures a uniform high grade crushed lime rock. From the scalping screen the dust is dropped to an inclined belt conveyor which transports it to a dump approximately fifty yards distant from the crusher building. This cast off material is occasionally used in small quantities if the mix will permit.

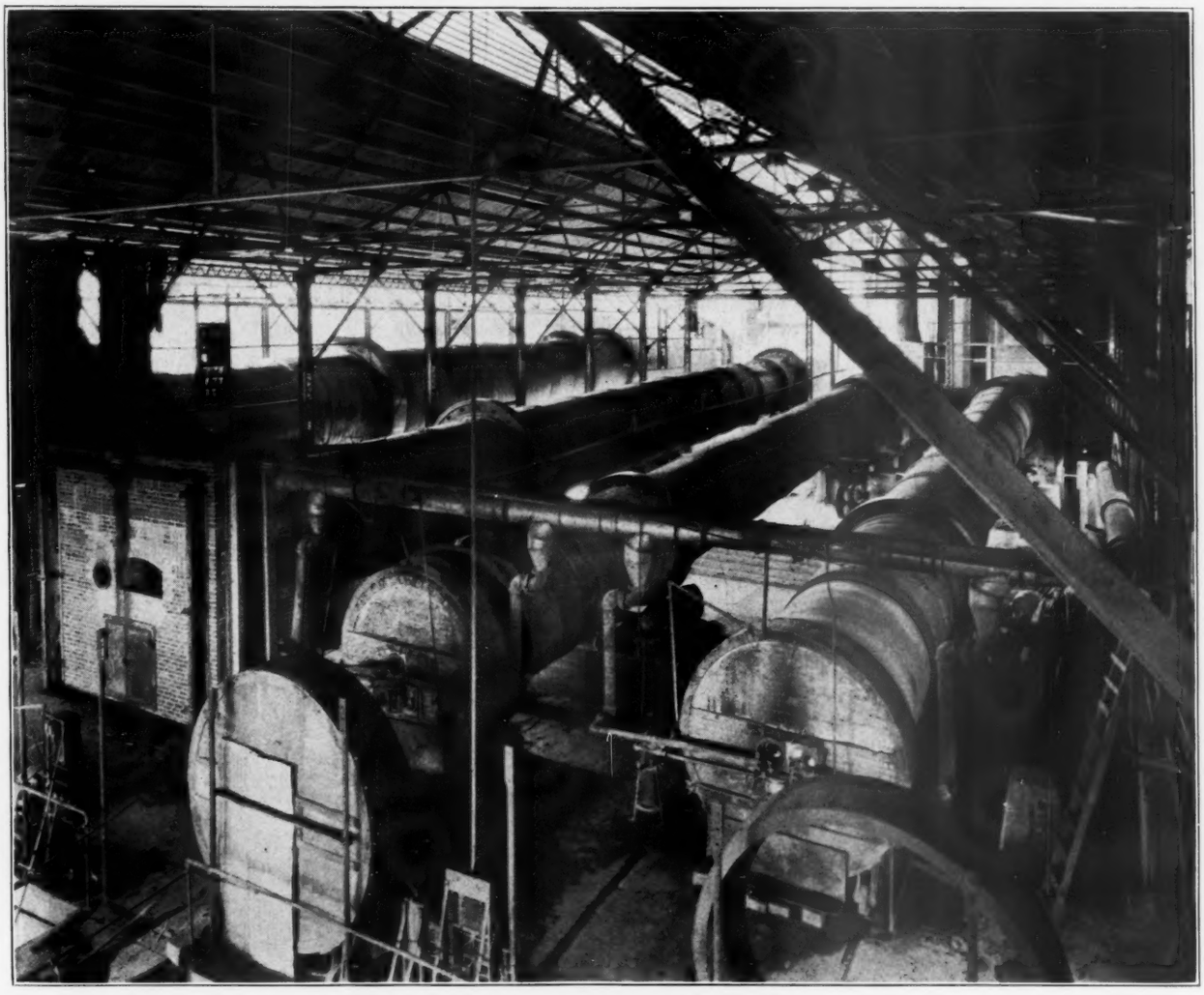
The cleaned lime rock drops from the end of the scalping screen into a bin from which point it is run off into 10-ton top-dump cars for hauling to the plant. Westinghouse starting equipment and wiring fixtures are used throughout the crushers.

Clay Pits

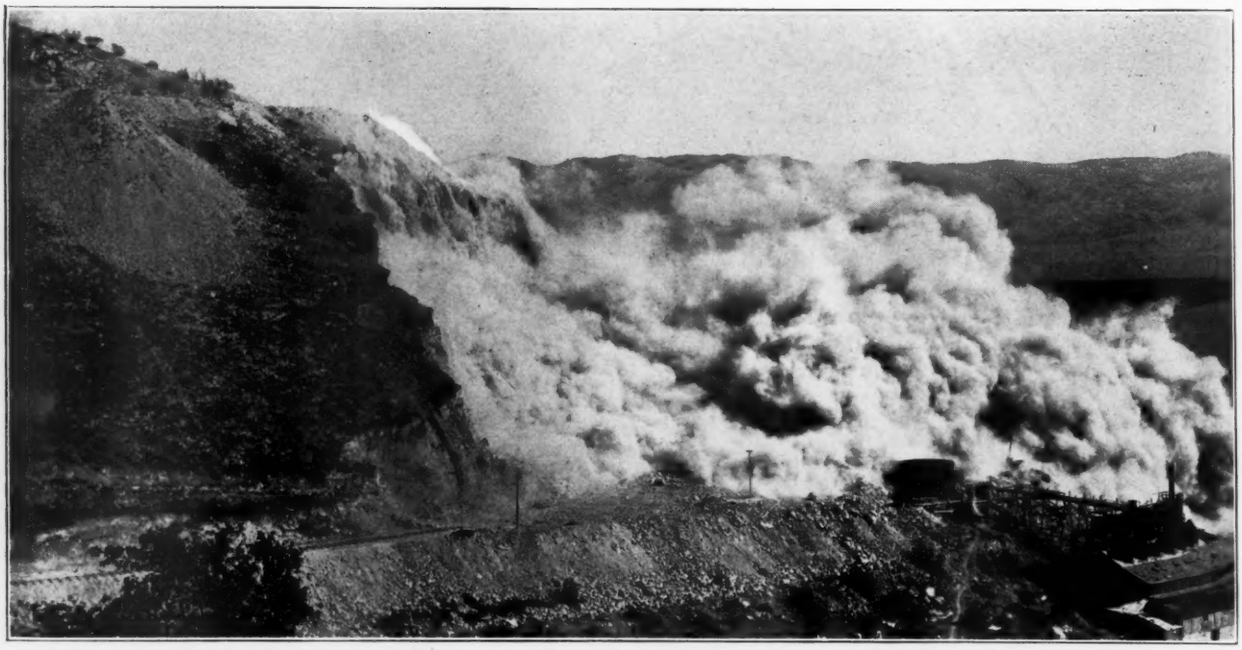
The clay pits are located approximately 3½ miles from the plant. The clay is, technically speaking, not a clay, although called by that designation for lack of a better name. It is a decomposed sedimentary deposit of igneous material with a ratio of silica to iron and alumina of about 1:80.

The clay is dug from the pits by means of a Sauerman drag line equipped with a ¾-inch yard bucket. The material is dumped on a grizzly over the clay bunker and by means of the grizzly all oversize material is rejected. The proper size material is dropped through the grizzly to the bunker and thence to 10-ton top-dump cars manufactured by the Monolith Portland Cement Company. The dragline equipment is powered by a Hendrickson

View of Quarry Showing Crusher Buildings to Right of Quarry Floor



Kiln Room of Monolith Portland Cement Company



View of Blast at Monolith. In this Instance 70,000 Pounds of Dynamite Placed 250,000 Tons of Limestone on the Floor of the Quarry

View Taken After the Blast Shown Above. Note the Excellent Size of Stone and Its Position For Loading

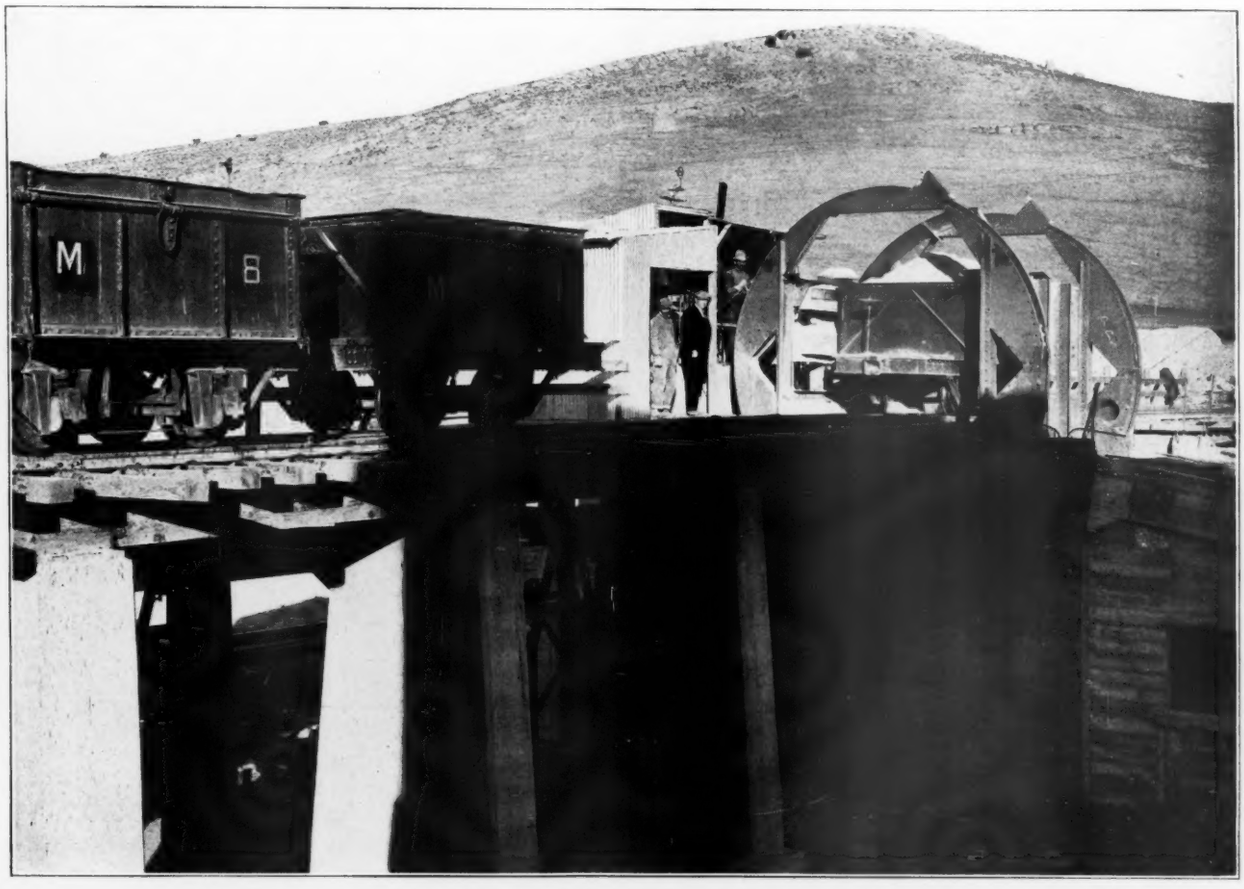
View of Clay Pits

two drum hoist which in turn is operated by a 75 h.p. Westinghouse motor.

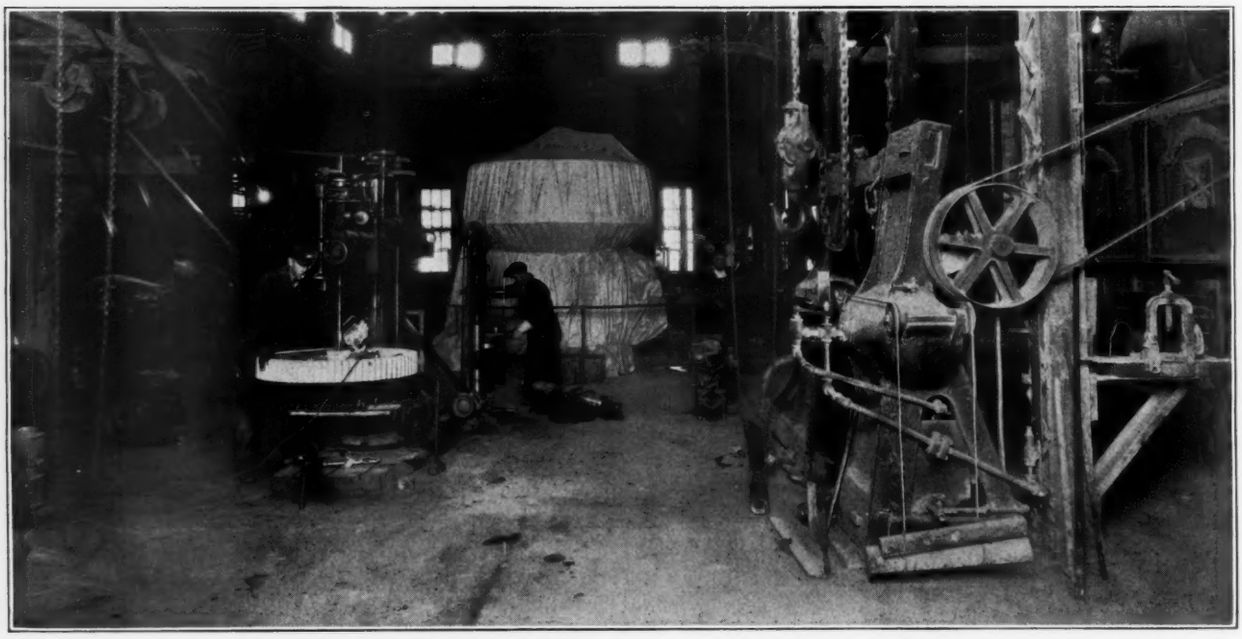
Railroad

The railway system of the Monolith Portland Cement Company consists of approximately fifteen miles of 36-inch gauge track, two 35-ton Vulcan steam locomotives and forty-three 10-ton top-dump cars. Twelve men are used in operation and repair work on the railroad, working in two 8-hour shifts —six men to the shift. Rock and clay are hauled from the quarry and clay pit by the Vulcan locomotives.

A car dumper manufactured by Roberts and

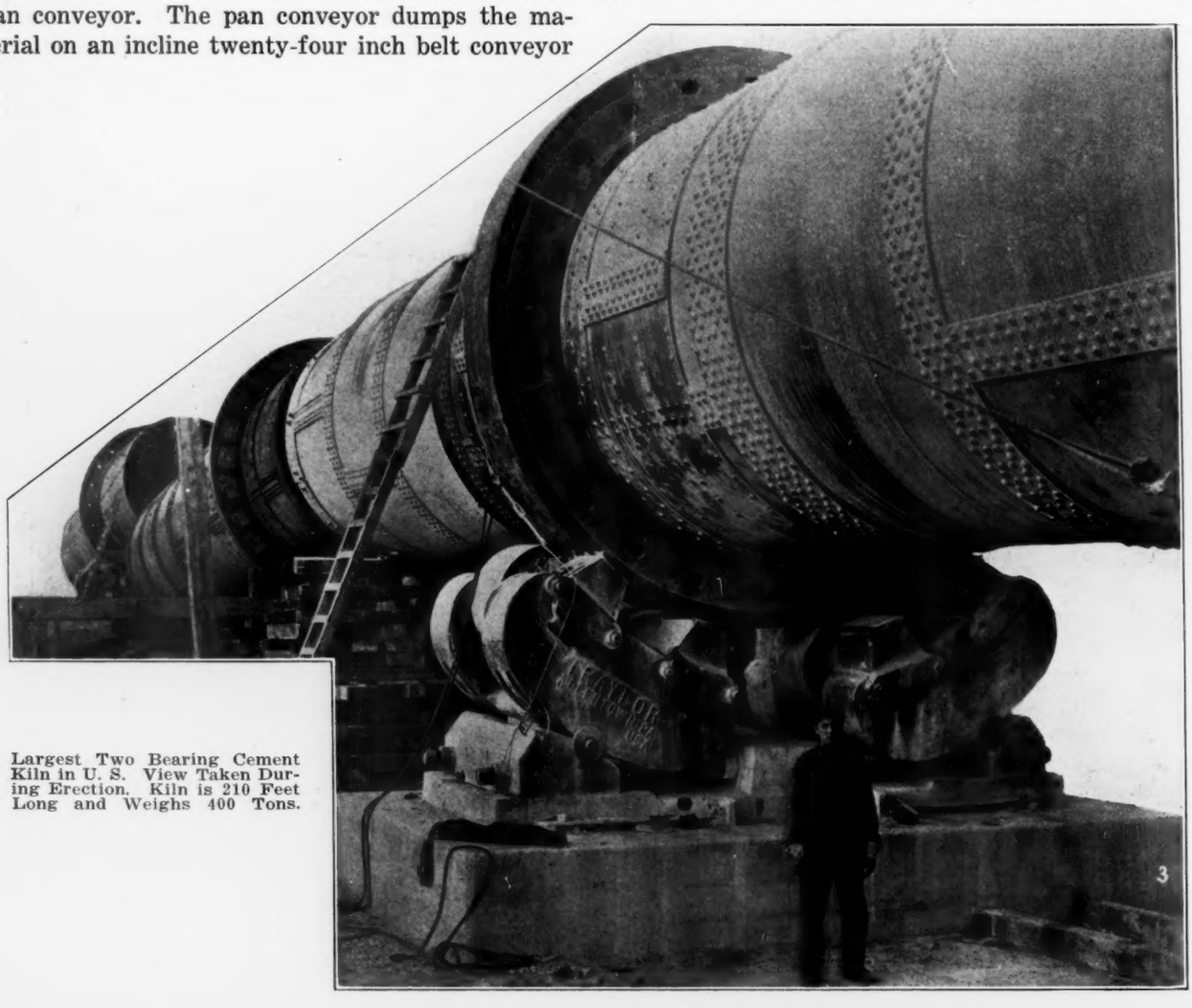


Car Dumper About to Discharge Load to Primary Crusher



Interior of Machine Shop

Schaefer Company and operated by compressed air is used to dump the cars. Only ten seconds are required to turn over a car and return it to its upright position. From the car dumper bin the material is run on a 30 inch by 14 feet, 6 inches pan conveyor. The pan conveyor dumps the material on an incline twenty-four inch belt conveyor which dumps the limestone and clay in their respective storage piles. A Sauerman dragline power scraper is used in connection with the rock and clay storage for the purpose of keeping the piles spread over as large an area as possible, thus



Largest Two Bearing Cement Kiln in U. S. View Taken During Erection. Kiln is 210 Feet Long and Weighs 400 Tons.

allowing a larger tonnage to be maintained in the stock piles.

Proportioning

From the storage the rock is taken by means of a tunnel conveyor to a bucket elevator with buckets 18 by 18 by 12 inches. The bucket elevator dumps the rock into a large metallic bin over a Schaffer poidometer. The clay is handled with equipment similar to the rock equipment but must of necessity be a separate unit.

From the bins above the poidometer the material is drawn through the poidometer using a thirty-six inch rubber composition belt on the rock side of the poidometer and a twenty inch rubber composition belt on the clay side. The proportioning is done as correctly as possible through the poidometer and a later and more exact proportion made in the slurry tanks.

From the bin below the poidometer and mixed material is elevated by means of a bucket elevator with buckets 24 by 18 by 12 inches. This elevator empties on a 30 inch by 12 feet pan conveyor which in turn empties on a 24 inch by 40 feet can conveyor which is used as a shuttle conveyor. The shuttle conveyor empties the mixed material in a dry state into the feed bins above the compartment mills.

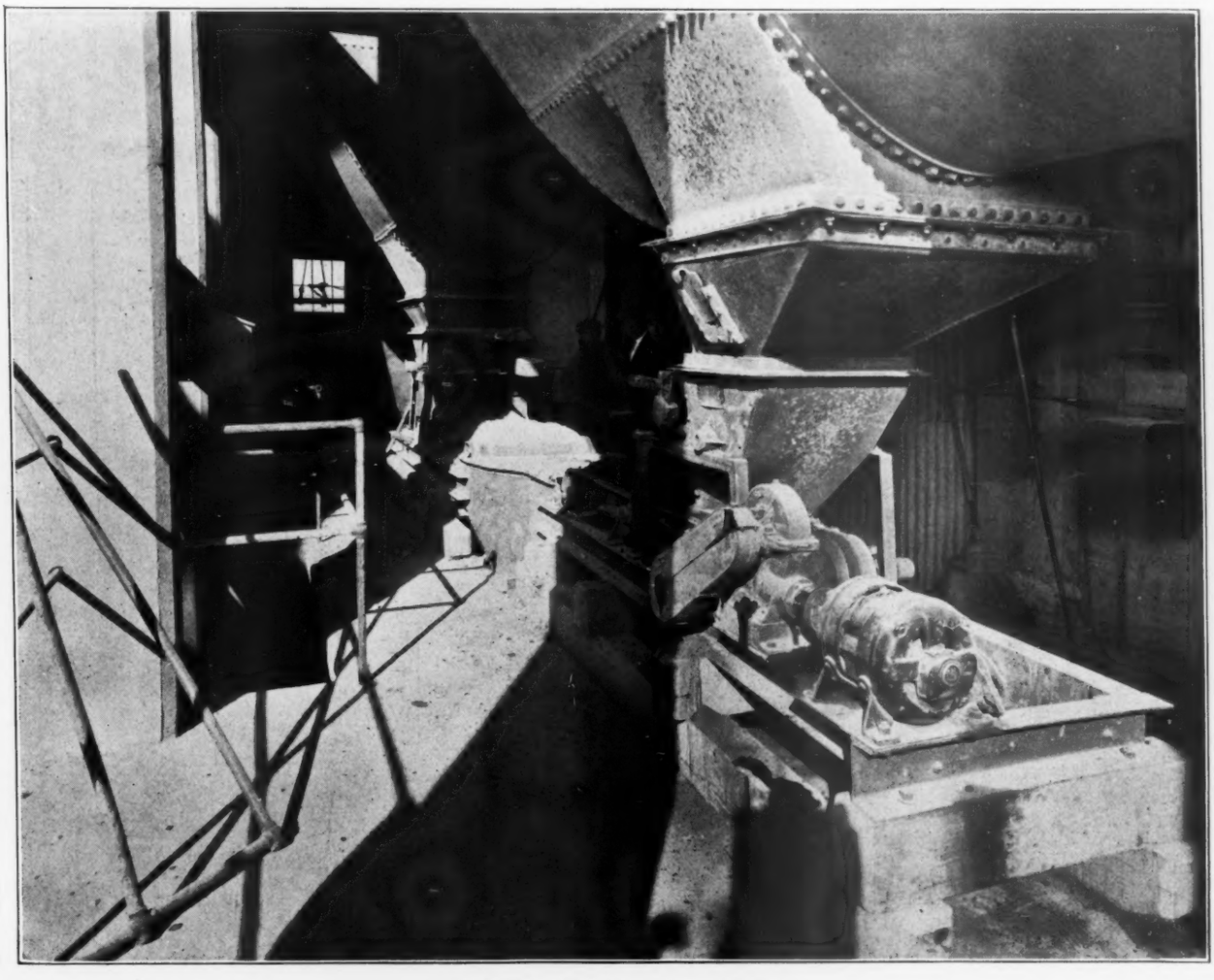
Raw Grinding and Slurry Tanks

Four 7 by 20 foot Worthington two compartment mills are used as raw grinders. The raw mix being mixed with water in the proper proportions at the feed end of the mill and leaving the mill in slurry form.

Four 500 h.p. General Electric synchronous motors drive the mills by direct connection through the flexible couplings. These motors have one hundred and eighty-seven and one-half revolutions per minute. An electric hoist with tracks completely spanning all of the four mills is maintained to facilitate repair work.

From the compartment mills the slurry is pumped into two concrete slurry tanks each measuring 16 by 12 feet and having a capacity of four thousand eight hundred and twenty-four cubic feet. Two three inch Wilfley pumps are used to pump the slurry from these original tanks into six concrete tanks each measuring 20 by 24 feet and having a capacity of forty-five thousand two hundred and sixteen cubic feet. These tanks are used to store slurry.

From these storage tanks the slurry is pumped



Poidometer For Dry Proportioning

to the mixing tank and in this change any correction in mix that may be needed is made. The slurry is then pumped by means of a six inch Wilfley pump to the two kiln storage tanks each measuring 20 by 32 feet and made of reinforced concrete. Two three inch Wilfley pumps are used to pump the slurry to a point where a Ferris wheel feeder is used to feed the slurry into the kilns.

All slurry tanks are equipped with Dorr agitators and as an additional assurance of positive agitation compressed air is used. This compressed air is furnished by a Sullivan compressor type W. G. 6 size 12 by 12 inches. Superintendent Garrison called the writer's attention to the fact that formerly all slurry had been transported by means of bucket elevators. This had proved very unsatisfactory however, so the Wilfley pumps were installed which had proven very efficient.

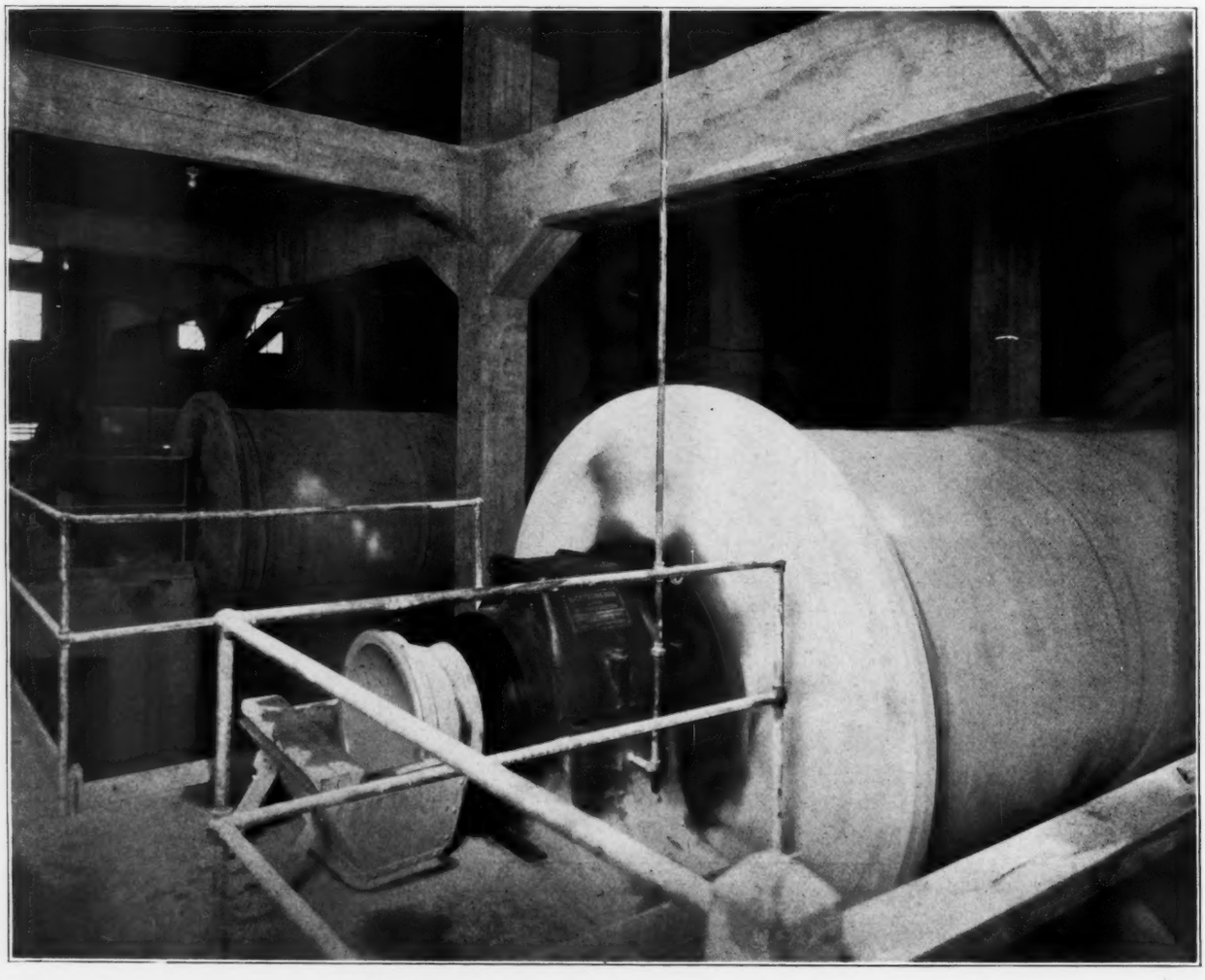
Kilns

Four Traylor built kilns are in operation. One 10 by 200 feet with a 11 foot burning zone and three 7 feet, 6 inches by 200 feet with a 10 foot burning zone. These kilns have a total daily capacity of 4000 barrels. Fuel oil was formerly used as fuel for the kilns but recently natural gas was piped in from Bakersfield and Taft oil fields some fifty miles distant. This gas is furnished at one hundred pound pressure and is then cut down by two steps to seven pounds pressure before being sent to the kilns. At the kilns Date Jones gas burners are used in connection with Sturtevant fans. According to Mr. Watson, Chemist, it is easier to maintain a constant temperature with natural gas as fuel and consequently there is less wear on the kiln lining, also in his opinion a more uniform clinker is obtained. However, as he stated, the installation has not been in long enough to permit a thorough check against fuel oil as a fuel.

Kiln patching is accomplished while in operation by the use of Adamant high temperature cement. The use of Adamant in this manner has obviated many shut downs for small patches, and caused a consequent increase in kiln efficiency. Hytenpite cement is used in connection with fire brick for the kiln hoods. A drag conveyor is used to remove the clinker from underneath the kilns. The drag conveyor takes the clinker to a pivot bucket elevator and conveyor which distributes the clinker to the clinker pile.

Finish Grinding

From the clinker storage the clinker is spouted to an underground tunnel through which a belt



Discharge End of Compartment Mills in Raw End

conveyor runs conveying the clinker to a bucket elevator. From this elevator the clinker is dumped on a belt conveyor which conveys the material to the five ball mill feed bins. Gypsum is added by hand during the above transportation stages. Four number eight Krupp ball mills and one Allis Chalmers number eight ball mill are used as a preliminary grind for the clinker. Five inch manganoid steel balls are used as a grinding element.

A twelve inch screw conveyor removes the material from beneath the ball mills and conveys it to a bucket elevator. The bucket elevator dumps the material in a shuttle screw conveyor which in turn empties into a screw conveyor over the tube mill feed bins.

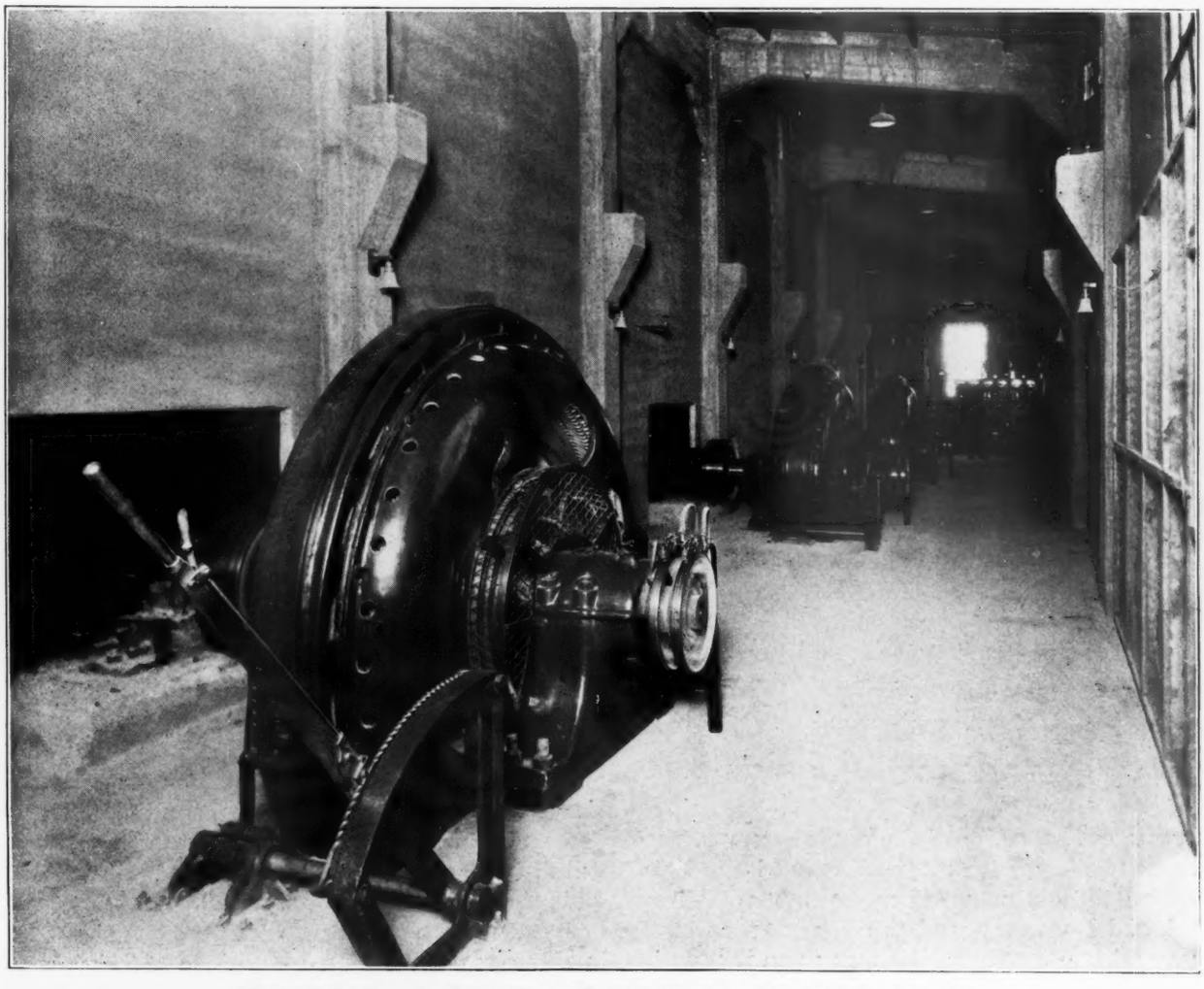
Six 5½ feet by 16 feet Krupp tube mills and four 5 feet by 20 feet Allis Chalmers tube mills are used for the finish grind all using ⅞ inch manganoid steel balls for grinding. Of the ten mills, eight are grinding standard cement and two are grinding plastic cement. It might be well to mention at this point that the plastic cement is manufactured under Olsen patents and through a secret process so the writer is not at liberty to give a detailed summary of this process and the equipment used. However, the processing of the cement is performed after the clinker has left the ball mills and before it reaches the tube mills.

Two separate conveying units are maintained to convey the cement from the tube mills to the rock house. One unit being used for standard cement and the other for plastic cement. Each unit consists of a screw conveyor operating under the discharge end of the mills, thence to a bucket elevator which empties on a twenty-four inch incline belt conveyor. The belt conveyors empty the cement into the standard cement and plastic cement storage bins. These bins are constructed of reinforced concrete.

Stock House and Packing Department

From the stock house bins the cement is drawn out by means of a spout to a screw conveyor underneath the bins. The screw conveyor empties the cement into a bucket elevator. The bucket elevator empties into a small bin from which screw conveyors convey the cement to bins over the two packers.

Two 3 valve Bates valve packers are used. The filled bags falling from the packer spouts direct to portable belt conveyors. The belt conveyors take the bags of cement to a hand truck stationed inside



Three of the Four 500 H. P. Motors Driving Compartment Mills in Rear End

of the railway cars where the cement is stacked for shipment. Two spur railroad tracks are provided one track on each side of the packing house thus facilitating loading.

Machine Shop and Auxiliary Power Unit

A complete machine shop is maintained to take care of all necessary repair work. To the right of the machine shop as shown in the accompanying photograph, four 250 h.p. steam boilers are maintained together with complete equipment for generating electrical power. This equipment is a heritage from the old plant operated by the City of Los Angeles, however, it has already proven it's value. In 1924 a power shortage was felt all over California due to a very dry year. All the other cement plants in Southern California were compelled to operate on a very restricted schedule due to this shortage. Monolith was able through the use of this power equipment to operate at full capacity.

A complete laboratory is maintained in the same building with the offices. The laboratory is under the charge of C. W. Watson, Chief Chemist. A great deal of credit is due Mr. Watson for the high quality of Monolith cement.

A complete camp consisting of a number of comfortable cottages and a mess hall has been built to care for the employees. The buildings are built with Monolith Plastic cement used as a stucco and the quality of this cement is proven by the way the buildings are standing up under the rather severe changes of weather experienced at Monolith. Extreme heat is felt during the summer and due to the altitude of 4000 feet, snow and freezing temperatures are often experienced in the winter. The engineering is in the very competent hands of F. J. Anderson who was formerly connected with the Chino Copper Company of Arizona.

A subsidiary company has been formed under the name of the Monolith Midwest Company and a plant is under construction near Laramie, Wyoming. In connection with this it gives the writer great pleasure to announce a number of promotions in the parent company.

Mr. Carroll Low, formerly Sales Manager, has been advanced to the post of Vice President-General Manager; Mr. T. R. Larson, from Traffic Manager to Sales Manager; Mr. M. A. Garrison from the general office to the position of Superintendent at Monolith; Mr. W. S. Trueblood from Superintendent to Production Manager.

Pit and Quarry Type Appreciated

J. F. Talbot, president of Dolese and Shephard Company, writes, "Pit and Quarry is a very attractive paper and very instructive. It has large type, a feature the old man will appreciate, well illustrated, and I am very glad to add my approval of its general appearance to the many you will probably receive."

Residential Building Studied

More than one-half of the residential shelter now being created by new construction in cities is under the roofs of apartment buildings, each containing quarters for three or more families. Residential buildings are becoming multi-family buildings.

According to a study just completed by the U. S. Labor Department covering all principal cities of the United States, a total of 397,966 family quarters were provided by new construction during 1926 aside from quarters in double houses. Of this total, 188,121 family quarters were in the form of single dwellings, representing 47 per cent of the total. In apartment houses or multi-family buildings, new quarters were provided for 209,845 families representing 53 per cent of the total number of new residential quarters which were created during the year.

Rent Level Going Down

Rents are declining throughout the United States, according to an investigation made by the Federal Government. The decline began in 1924 and is continuing gradually, it is shown. The investigation was made by the U. S. Labor Department which receives reports every six months from all principal cities. According to these reports the level of rents is approximately 62.1 per cent higher than in 1913. But a year ago the rent level showed an increase of 65.4 per cent above pre-war days while in 1924 the comparative increase was 68 per cent above 1913.

According to the Labor Department's data the rent level shows a decline of 2 per cent in the last twelve months and a drop of about 3.5 per cent since 1924. The advance in rents that followed the World War as a result of the nation-wide housing shortage was an important influence in the advance in the general cost of living that resulted from the war. Prices of food, clothing and other necessities began to recede from the war time levels in 1921 but rents were slower to respond to changing conditions.

Small Applications of Lime Bring Results in Virginia

The results reported in New Jersey Agricultural Experiment Station Bulletin 430 show that smaller applications of lime than are commonly recommended are profitable. The common recommendation in Virginia has been to use one ton of burnt lime or two tons of ground limestone or marl. Results of tests conducted in different parts of Virginia show that the application of one ton of burnt lime or two tons of ground limestone per acre once in a four-year rotation gave a return of $40 for the rotation.

PACIFIC COAST GRAVEL PLANT RECOVERS GOLD, SILVER AND PLATINUM

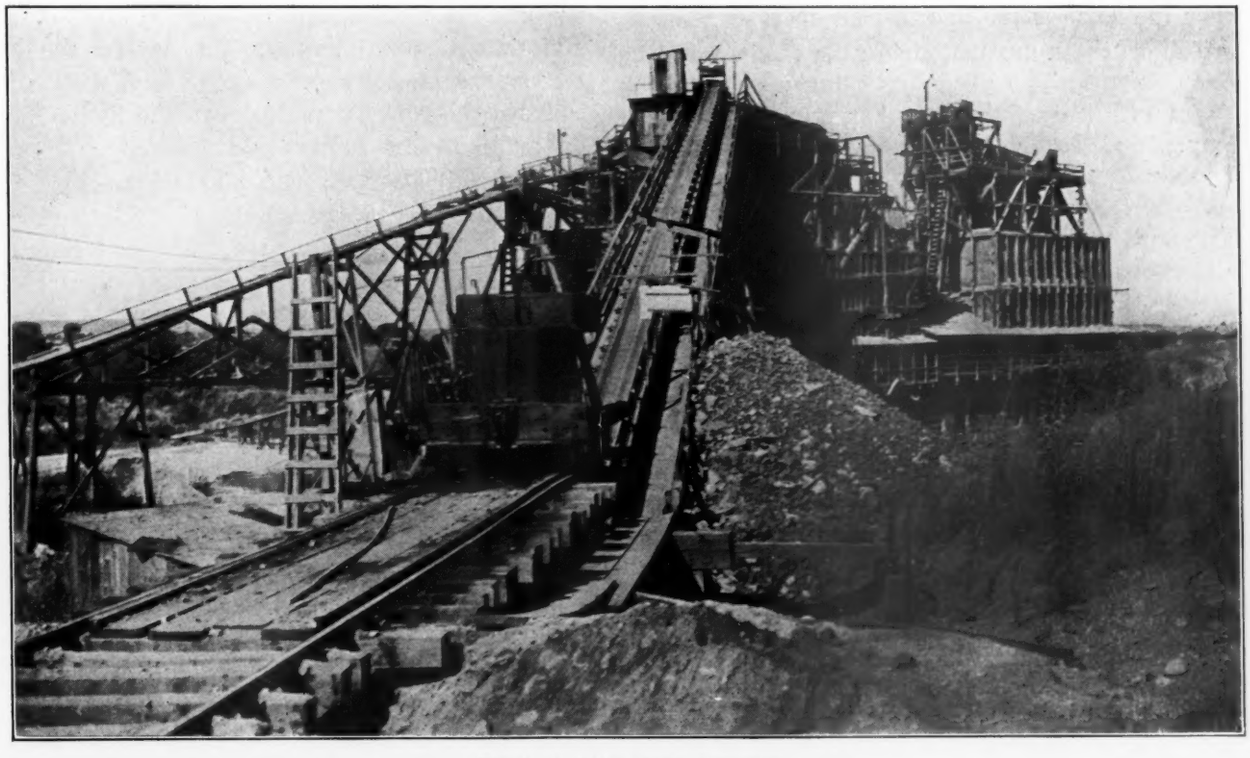
LOCATED on the Stanislaus River, near Oakdale, in the central part of California, is the plant of the Atlas Rock Company. The Stanislaus River winds through the Mother Lode Gold country of California, by reason of which gold, silver and platinum of considerable value are recovered at the plant along with the regular gravel operations. The deposit being worked at present is an old river bed. It is about twenty feet deep, and consists of sand, gravel up to 2½ inch, and cobbles up to 16 inches, in about equal proportions. The plants consists of a washing plant, where sand, gravel and cobbles are washed and screened, and a crushing plant where the cobbles are crushed, washed and screened to produce a high quality crushed rock.

The material is excavated by a Marion 36 dragline steam shovel, having a yard and one-half Page bucket. The present deposit is about one mile from the plant and is reached by a standard gauge railroad built of 50 pound steel. Material is transported by means of 12 yard Western air dump cars. When operating on a 1,000 ton per nine hour basis, three cars and an 18 ton Plymouth gasoline locomotive are used. When it is necessary to produce more material, another train is added, in which case the Plymouth locomotive pulls two cars, and an 18 ton Vulcan steam locomotive pulls three cars.

On arriving at the plant, the material is dumped into a steel lined hopper and is fed to a conveyor by means of a Bodinson reciprocating feeder. The belt on this conveyor is 30 inches wide, 7 ply, manufactured by the New York Belting Company. The conveyor is 260 feet long, and is inclined 16 degrees.

The conveyor moves the material to the top of the plant where it is dumped into a 60 inch screen 28 feet long. The first 5½ feet consists of a scrubber within which longitudinal angles lift the material and drop it back to the bottom of the scrubber. This action, with the help of water, breaks up the softer material and loosens the silt and earthy matter adhering to the gravel and cobbles. The next 14 feet of the screen consists of a 2 and 2½ inch perforation, which is surrounded throughout its entire length by a jacket 84 inches in diameter. The last 5 feet of this packet may be replaced by a section having 1¾ inch perforations, if it is desired to produce 1½ inch gravel instead of 1 inch gravel. The remaining 5 feet of the screen consists of a section having 4 inch perforations. After the material leaves the scrubber and passes to the next section, the 2½ inch material down, passes through and to the jacket. The material larger than 2½ inch passes to the 4 inch perforated section. The 2½ to 4 inch material passes through and drops to a bin below.

The rejected material drops to another bin. The last two bins referred to act as storage bins for two crushers, which will be described later. Returning to the material which has passed through



Plant of Atlas Rock Company

the 2½ inch section to the 1¼ inch jacket surrounding same, the rejected material on this jacket is the finished product, 2½ to 1 inch gravel. A stream of water washes this material as it moves to the end of the jacket. The material, passing through the 1¼ inch perforations, is divided into halves and fed to two double conical screens. The inner of these conical screens is 36 by 58 inches, 80 inches long and has ⅝ inch diameter perforations, the outer conical is 48 by 70 inches, 74 inches long and has ⅜ inch perforations. The material rejected on the inner conicals produces 1 inch gravel which material drops to bins below. The material passing through the inner conicals and rejected on the outer conicals is pea gravel which also drops to storage bins underneath. In the conical screens the material is given a thorough washing by means of high pressure streams of water. The material, passing through each of the outer conicals, consisting of sand, waste and precious metals, passes over two sets of Hungarian riffles by means of which gold, silver and platinum are recovered. The sand and waste passes to two log washers, which remove the waste from the concrete sand, and convey the latter to a storage bin.

When plaster or mortar sand is to be produced, a chute is interposed so as to catch the concrete sand as it falls from the log washers, whereby it is conveyed to a 4 by 10 foot Link-Belt vibrating screen, which divides the concrete sand into two products. That which passes through the screen is plaster and brick mortar sand and that rejected is a coarse sand graded from ¼ inch to 10 mesh, which is used for asphalt concrete road dressing. It is also used to coarsen the concrete sand when ever the same is too fine to pass specifications.

The crushers are placed in rear of the washing plant, between it and the crushing plant. An 18 by 14 inch Farrell jaw crusher crushes cobbles 4 inches and larger. A three foot Symons cone crusher crushes the 2½ to 4 inch material, and also the 1 to 2½ inch gravel. When crushing the larger material the opening is set so as to produce 1 inch crushed rock. When crushing the smaller gravel, the opening is reduced to make ½ inch crushed rock and rock dust products. The capacity of this crusher is 80 tons of 1 inch crushed rock per hour. It is therefore great enough to crush both the 4 inch gravel and the 2½ inch gravel which is done whenever there is no sale for 2½ inch gravel. When this condition exists the opening of the crusher is changed once a day. The feature of being able to change the opening of the crusher in 30 minutes and that without stopping the crusher was the main reason for replacing a 36 inch Symons vertical disk crusher with the cone crusher.

The crushed rock from both the crushers discharges into a 7 by 11 by 15 foot bucket elevator, by means of which the material is elevated 70 feet to the top of the crushing plant. Here it is discharged into a 42 inch screen, 24 feet over all. About one year ago the perforated steel in this screen was replaced by Rolman woven manganese steel rod screens, manufactured by the Manganese Steel Forge Company whereby the capacity of the screen and the quality of the material were both greatly increased. The first section of the screen is 8 feet long, ⅞ inch square openings and is made of ¼ inch rods. Around this section is a dust jacket 7½ feet long which has ½ inch square openings. The next section of the screen is 7 feet long and has 1⅛ inch square openings made of ⅜ inch rods. The last section is 6 feet long, has 1¾ inch square openings and is also made of ⅜ inch rods. As the material is discharged into this screen the first section removes the dust to 1 inch rock. The ½ to 1 inch rock is rejected by the dust jacket and passes over a perforated chute, which removes any dust which might still cling to this product. A chute catches the dust and directs it to the dust bin. ½ to 1 inch material then drops to a storage bin below. The dust to ½ inch material, which passes through the dust jacket, drops to a chute, which feeds this material to a Leahy vibrating screen, which divides this product into dust to ⅛ inch crushed rock and clean screenings. If it is desired to produce dust to ⅜ inch crushed rock, which is used in California for the manufacture of concrete irrigation pipe, a change of screen cloth on the Leahy screen is necessitated. The material rejected by the ⅞ inch screen passes to the 1⅛ inch section where the 1¼ inch crushed rock is removed and drops to the storage bin below. The next section of the screen produces 1½ inch crushed rock in the same manner. The rejects from the screen are discharged to an 18 inch belt which conveys the rejected material to the Symons cone bin and is in turn fed to the crusher.

The materials from both plants are loaded from the south sides of the plants direct into railroad cars. Ore bin gates are used. The materials pass from the bins to the cars over perforated chutes where a final washing is made. The waste material and soiled water are caught by a return chute and deposited in a trough running along side of the plants and flumed off. Two 30 inch mixing belts run along the north side of the plants whereby the products are graded to meet any specification. The mixing belt on the gravel plant conveys the material to a 3 by 8 foot Link Belt vibrating screen, where the material is again thoroughly washed before loaded into railroad cars. By means of this final washing the cleanliness of both the crushed rock and the gravel is greatly improved. It was found that no matter how clean the material was before dropping into the storage bin, after remaining there for any length of time the material was

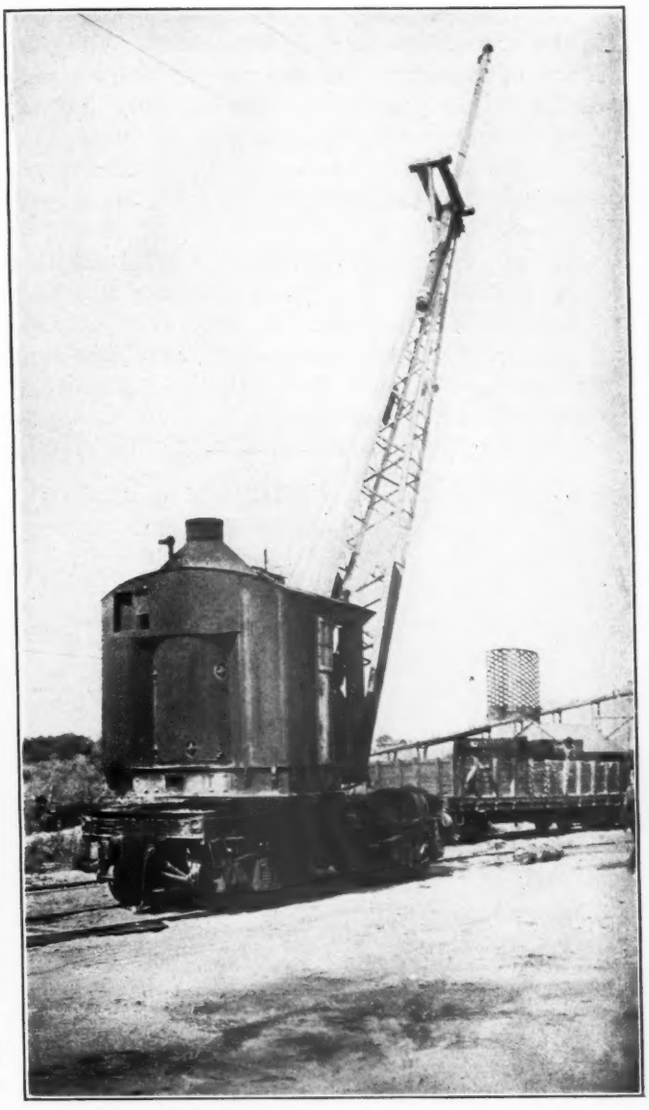
discolored on being drawn from the bins. The final rewash just described was the means used to solve this problem.

Three hundred and ninety horse power are required to operate the plant. General Electric sleeve bearing motors, Fairbanks Morse sleeve bearing motors and Fairbanks Morse ball bearing motors are used. The water supply is furnished by a one 6 inch single stage, double suction De Laval pump, directly conected to a 75 h. p. General Electric motor. The pump is placed in the Stanislaus River, and is connected to the plant by means of a 10 inch pipe line. Two thousand gallons of water having an approximate pressure of 20 pounds are obtained at the top of the plant.

The storage system consists of a 20 ton Brownhoist locomotive crane and 7 ton Plymouth locomotive. Owing to the fact that the storage ground is about ¼ mile from the plant the Brownhoist does not move cars of material back and forth between the plant and the storage ground but confines its efforts to loading and unloading material. The 7 ton Plymouth locomotive moves materials to the storage ground and does all the necessary switching of cars in the yard.

Different sizes of sand, gravel and crushed rock are produced. The sands are used for concrete, plaster, mortar and road dressing. The gravels are used for road dressing and concrete work. The crushed rock products are used for concrete, asphaltic concrete roads and macadam roads. A continuous effort is made to increase the quality of Atlas Products.

The entire operations of the company are worked out on a budget basis. First the year's sales are estimated. After this estimate has been checked, the operations of the plant are laid out so as to produce the required sales tonnage at the most economical cost. Having kept detailed records of cost, sales, delays, and purchases, it is not very difficult to figure out the entire costs of operation a year in advance. It has been found that by interesting the men at the plant in a budget system and by sending each man who operates or assists in operating any equipment a monthly cost record of his equipment, surprisingly low operating costs have been obtained. A steam shovel operator is no more able to cut the cost of production without having detailed costs records, than the general manager is able to cut his costs without past performance records with which to check. The management does not keep the cost records a closely guarded secret, instead it tries to interest every man in the organization in them. The pertinent points in production costs are posted daily on a bulletin board informing everyone as to such items as: Tonnage produced; man hours delay caused by different equipment and parts of the plant; tonnage produced per man hour, and other items of interest. These items are all watched with keen interest and



Locomotive Crane Showing Boom Extension for Hoisting Screen Section to Top of Plant

serve to make every man of the organization feel that his particular duty is of vital importance in the economical operation of the plant.

A purchase record is kept on such items as wire rope, screen cloth, crusher parts, and all other replacements. By means of this record much money has been saved because it has eliminated a greater part of the ever present question as to whether the most expensive or the cheapest material is the most economical per ton. Because of this record, manufacturers have made replacements that would not even have been requested without it. More favorable purchase contracts have in several cases been made possible because of this record.

The labor question has been given a great deal of thought at the plant of the Atlas Rock Company. The policy of fair wages, fair treatment and a vacation from one to two weeks for everyone employed longer than one year has been in force. The low production costs, the loyalty of the men, and the low labor turnover have shown the wisdom of the above policy.

The territory served by the Atlas Rock Company, is the northern part of the San Joaquin Valley, the Delta of Stockton and the Mother Lode country of California. Although this territory has been greatly overproduced during the past four years, it is expected that the continued growth and prosperity of this part of California will soon rectify this condition.

The officers of the company are, A. C. McMillan, President; Alonzo W. Stone, Secretary and Treasurer; N. F. Jones, Plant Superintendent, and Fred R. Beerman, General manager. The offices of the company are located at 47 North Grant Street, Stockton, California.

Association to Push for Highway

The American Motorists Association is to inaugurate a campaign to provide modernly built highways in every state and county in the nation. This campaign proposes the utilization of the $417,000,000 due the United States for war materials purchased following the Armistice, which material was previously allocated to the states in this country. Ten per cent of this sum is to be used for national defense roads leading into the National Capitol, and ninety per cent to the states and the District of Columbia, proportionately.

Promotion of both safety and prosperity by putting road building on a par with other major activities of the country is proposed. Stopping the economic waste resulting from the operation of billions of dollars worth of practically 100 per cent efficient motor vehicles over roadbeds that now cause an automobile deterioration of 40 per cent is another plank in the platform.

"The main benefit accruing to us from our participation in the World War, in addition to the quick ending of the war, was the impetus thus given to the improvement of highways," said Dr. S. M. Johnson, chairman of the Good Roads Board of the A. M. A., "but in failing to properly capitalize this asset we have committed the stupendous economic error of the age.

"The result is, we stand as a nation indicted for economic negligence. What is to be the demurrer filed? What steps are to be taken to remedy the error? The answer is plain. We should carefully appraise our assets and proceed intensively and aggressively to realize upon them before it is too late.

"Congress, during the session which convenes in December, should promptly enact legislation, for one thing, under which the $417,000,000 for which France is indebted to the United States for machinery, material and supplies purchased following the Armistice, shall be devoted to a War Memorial Fund for the construction of certain highways and boulevards that would, first, remind all succeeding generations that we went to the aid of Europe in her hour of need.

"Second, ten per cent of this fund should be promptly utilized in the building of permanent roads radiating from the different sections of the country that lead into the National Capitol, both as a defense and a prosperity measure, and ninety per cent should be allocated to the various states and the District of Columbia."

It is too late to correct what already has been done, yet it is a fact that some of the $400,000,000 worth of road materials which the United States sold in France for twenty cents on the dollar was re-sold to syndicates which re-sold same at pyramided prices in Chicago, New Orleans, and elsewhere, equipment which we should have had for nothing. Some of it was used to build and repair roads in France. All of it went into the permanent assets of France. It had nothing to do with saving France from the enemy. It was purely a commercial transaction.

"Later, France purchased $17,000,000 worth of surplus war property in this country for which she executed obligations of a million dollars each, and bearing five per cent interest. France has never defaulted in payment of this interest, and two years hence, when the notes mature, she undoubtedly will pay or execute negotiable securities instead."

Dr. Johnson calls attention to the need for closing immediately the gaps between the 90,000 miles of roads comprising the system of main arterial highways selected through joint federal and state action, as one of the first practical steps in the complete paving of the nation's highways.

Government Aids With Irrigation

Approximately 2,264,600 acres of desert in the western states now have been turned into fertile farm lands which are supporting thousands of families as a result of irrigation projects completed and put into operation by the U. S. Bureau of Reclamation of the Department of the Interior, according to an official announcement.

To maintain the Interior Department costs a few cents each year for each resident of the United States and of this Reclamation Bureau is responsible for the expenditure of only a portion.

The success of the various irrigation projects of the Federal Government has encouraged private capital to undertake similar projects which are supplying water to millions of additional acres of land that were formerly arid and unable to support plant life.

The government is increasing each year the area of land made fertile by its water projects. In 1917 the irrigated area included 966,784 acres which is equal to about 42 per cent of the area now watered by public projects. In 1926 crops grown on the government irrigated area alone were valued at $109,118,300. Crop production averaged $48.20 per acre.

TALC FROM THE SOUTHERN CALIFORNIA DESERTS

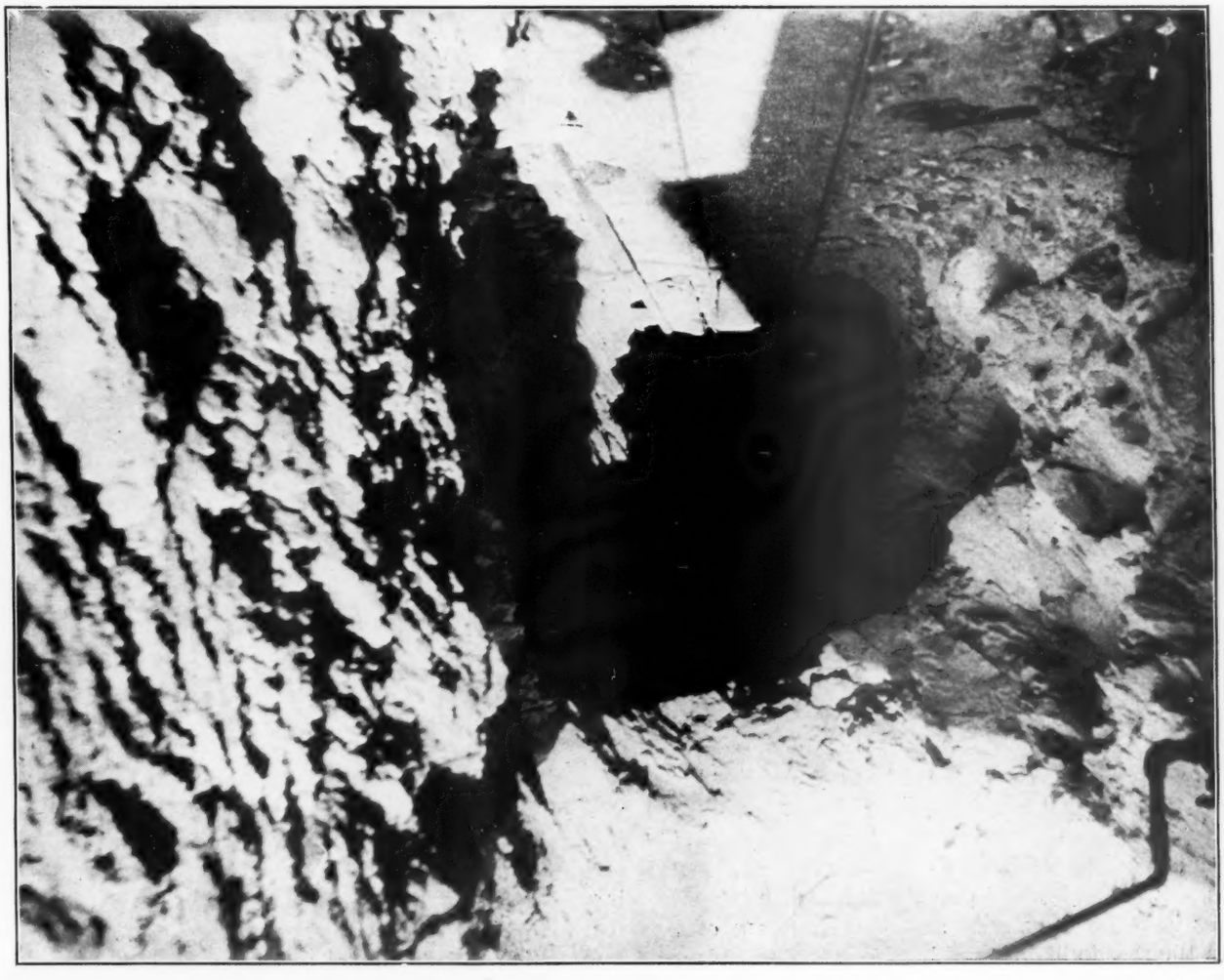
By Frank R. Wicks,
Consulting Mining and Industrial Engineer

WE OFTEN think of talc as a powder that comes out of a can and goes on the face and then comes off the face onto ones clothes. We do not give much thought to the true source of the talc or to the uses other than as a cosmetic. Talc probably has a wider range of uses or enters into a greater variety of industrial products without prior preparation other than grinding than any other natural rock mineral. On account of the many purposes to which it is put in every day life the story of its production from the crude state should be of interest to many.

The word talc is a general term, technically applied to a group of magnesian minerals which have certain definite chemical and physical characteristics. By common usage the name is also sometimes given to talc-like clays which may or may not belong to the Talc Group. In commercial terms the word talc is almost always meant to cover only the true talcs, excluding all soapstones, clay or other materials that are not actually talc. In the pure state talc is a crystalline, hydrous magnesium silicate having the chemical formula of 31.8 per cent magnesia, 63.5 per cent silica and 4.7 per cent water of hydration. It is a very resistant chemical compound, as talc cannot be reduced to its three major component parts except by strong acids plus intense heat. Pure talc is subtransparent to translucent, has a pearly luster and a very noticeable slip or greasy feel. The finely powdered talc is absolutely white, while the lumps may be white or pale green.

Talc occurs in the earth structure as a soft or semi-hard rock mineral, which has resulted from the alteration of older magnesian rocks. The purity of the talc deposit depends largely upon the completeness of the alteration of the parent rock as well as freedom from contamination after the deposit has been formed.

The value of usefulness of a talc deposit depends upon the exact form of the mineral, the purity of



Portal of 1700 Feet Main Tunnel

the deposit, cost of production, distance from the market, etc. Talc rarely occurs entirely free from impurities and is seldom found in large masses, hence the production of the crude material in useful form requires considerable skill and constant attention.

Powdered talc examined under the microscope may be seen as distinctly crystalline as salt or sugar, with well defined, semi-transparent grains, or the talc may be fibrous or apparently massive according to the character of the particular deposit from which the specimen is taken. Certain forms of talc are suitable for the manufacture of cosmetics and drugs of the best grades, other varieties are useful in paint manufacture, while other forms are needed for production of insulating blocks, marking pencils and the like.

Proper selection of the exact character of talc for any specific purpose is of great importance. For some uses purity demands first consideration, while in others the crystalline structure or fibrous character are of greater import than chemical composition. Sometimes talcs must be submitted to both chemical and physical tests to determine whether they can be used for a certain purpose. A massive talc will often produce an entirely different result from that shown by a true crystalline talc under apparently similar conditions of manufacture.

The major proportion of the production of the Pacific Coast Talc Company is a true crystalline talc, and it is said that the mines of this company are the only properties on the North American Continent that produce substantial tonnages of the crystalline form of this mineral.

The mining properties of the Pacific Coast Talc Company are situated near the north-east corner of San Bernardino County, California, about six miles easterly from the Tonapah and Tidewater Railroad, and approximately midway between the southern end of Death Valley and the present Arrowhead Trail, the main travelled highway through the desert regions from Utah to Southern California.

This region is made up of low lying desert mountains, dry sand washes and lake beds that are dry most of the year. Over wide areas the hills are practically submerged in sand and gravel and much of the true geological structure is therefore concealed. At the talc mines the hills rise several hundred feet above the floor of the desert and back of the main workings thus offering better opportunity for geological study.

The talc deposit takes the form of a ledge or vein which stands at an angle of 55 to 60 degrees. The vein is largely made up of a series of huge lenses which are connected by relatively narrow and short stringers or leaders of talc and tremolite. These lenses have no regularity as to size but are often 75 to 100 feet in length and in height. Some places in the mine show one lense partly overlapping another with a rib of waste rock between, giving the appearance of two veins with an aggregate width of 18 to 20 feet.

The enclosing walls of country rock in which the vein stands are principally pegmatite, diorite and serpentine. The diorite seems to predominate as the foot wall rock, but any of the three may be found on both sides of the main vein. On this account it is sometimes impossible to tell whether parallel lenses exist alongside of the lense that is being worked until a small stringer is found that leads off into the wall on one side or the other. No doubt portions of the deposit are overlooked in regular mining, but diamond drilling short holes from the main workings at a later date will probably locate such places or lenses as are at present concealed. The vein itself is made up of pure talc, which sometimes fills the entire space between walls, and sometimes is accompanied by a band of tremolite as wide or wider than the true talc.

The talc is apparently the result of the geological alteration of tremolite, which in turn probably had its origin in serpentine. The deposit is so constituted that it is possible to mine the talc practically free from tremolite if desired and entirely free from silica or limestone streaks, after which the tremolite can be taken out separately.

The walls of the ledge are hard and tight, and in many places are very smooth, showing slicken-sided condition due to fault movement. Thus the talc and tremolite can both be mined almost absolutely free from waste rock of any kind. As an average the vein at and near the surface shows a mining width of about four feet. This width gradually increases with depth so far as present workings have extended so that the average width on the bottom level of the main workings is now nearly eight feet. Increased depth also seems to show a reducing proportion of tremolite and a corresponding increase in percentage of pure talc.

The early development of the ledge was accomplished by a series of shallow shafts, open cuts and short tunnels, these being so spaced that the vein was exposed about every 100 yards for a distance of one and one-half miles. These workings showed a surprising uniformity in width and quality of the vein.

During the first mining operations on the property the principal work was done through an inclined shaft, which ultimately reached a depth of 155 feet on the incline. Several years ago this shaft was connected with a new tunnel from the surface which started near the westerly end of the property.

The main tunnel has now reached a total length of 1700 feet and will be gradually extended as mining proceeds, so it may ultimately be about 6000 feet long. Of the 1700 feet now completed approximately two-thirds of the distance was in talc or tremolite, or both, while the other third was driven

through country rocks to avoid making the main workings too crooked.

The maximum height of stopes or surface above the main tunnel at present is about 200 feet, measured on the incline of the vein. This distance will gradually increase as the tunnel extends, so a total depth from the surface to the tunnel on the easterly end of the property will approximate 600 feet. Stoping usually extends nearly to the surface, with breaks through at intervals for air.

Above the main tunnel are two working levels and 75 feet below the tunnel another level has been begun. These three levels now total approximately 2500 feet in combined length and at the present rate of mining they are being extended a total of about 100 feet per month. Mining below the present lower levels will probably not be necessary for several years.

When deeper mining is required, it is planned to put down a new shaft near the northwesterly end of the claims, at a point where the collar of the new shaft will be only about 60 feet above the present tunnel level. This will reduce hoisting to a minimum for many years of operations and will somewhat improve the methods of handling both talc and waste at the surface.

Mining is conducted on the same principle as most metallic ore mines. Overhead stoping methods are used where possible. Chutes are placed at convenient points to drop the "ore" to the main levels, where it is drawn into the cars and trammed out to the bins by hand. The cars hold about one ton of talc and run on an 18″ gauge track. Very little wheeling or hand shoveling is necessary and by carefully removing the best quality talc first and then mining the second grade materials separately, the amount of sorting is reduced to a minimum.

Pillars are left in the main workings where the roof requires more support than can safely be given by stulls. Most of the pillars are low grade material while some others are partly merchantable talc which will be recovered later.

Mine timbering is a small item compared with most mining operations. An occasional stull in the stopes and a few posts around the chutes are about all that is usually required. Some of the stulls have to be very long and heavy if the vein is wide, but the walls do not require much support. Second quality dimension timber is generally used, which is purchased in Los Angeles markets. On account of the extreme dryness of the air the timber must season at the mines for a time before being used.

The proportion of waste handled in ordinary operations is relatively small. Of the total tonnage moved underground, including the driving of the main tunnel, only one-fifth is waste while the other four-fifths represent talc or talc materials of shipping quality. Very little waste is brought out to the surface as it is needed for backfilling stopes just above and just below the main tunnel level. Backfilling in stopes which connect with the two upper levels is not necessary as the ground pressure here is relatively light and frequent pillars were left to be removed later.

The mines are absolutely dry, which not only eliminates an important item of expense suffered by most mining operations, but it also minimizes the amount of ground movement and weight of

Looking Eastward Over the Property With Lines Showing Approximate Location of Talc Zone on Tremolite Mountain

walls that would otherwise be expected. It is doubtful whether any water or any substantial amount of moisture will be encountered for at least two hundred feet and even then the quantity that is to be expected is so small that it will be feasible to keep it down 200 feet below actual mining operations for months or years ahead of mining if such seems advisable. Mining of talc in this character of a deposit would be practically impossible under wet mining conditions.

Drilling is done by compressed air, using 7/8-inch hollow steel and Cochise drills of the jackhammer type. Blasting is done with 35 per cent dynamite, but only light loads are usually required. Slow speed powders and coal powders have been tried with indifferent success. Black powder cannot be used on account of discoloring the product, so that taken as a whole best results have been obtained with 35 per cent dynamite tamped well into the bottom of deep holes. This shatters the ledge so that it can be easily picked down after blasting.

It will be seen that mining conditions are such as to make possible a very low mining cost. A good average width of vein, fairly solid walls, overhead stoping, little timbering and little hoisting, small proportion of waste, easy drilling and blasting, and good natural ventilation. These things all help to make the operations possible, and were it not for these conditions profitable results could not be accomplished.

On the other hand, mining under desert conditions with intense heat during more than half of the year adds items of expense not ordinarily expected. It is necessary to haul water, fuel and timber from the railroad and to generate power required for the operations. Principally on account of the climatic conditions at the mines it was considered advisable to place the grinding plant in Los Angeles instead of nearer the mines.

The mining properties are 6½ miles from the railroad. A direct road across the desert flats connects with the private siding called Talc, California, a station on the Tonapah & Tidewater Railroad. This trucking road has an almost even one per cent grade down toward the railroad and it is maintained by carrying a light drag made of angle irons fastened behind the truck which resurfaces the natural gravel every trip.

Hauling is done by a ten-ton capacity White, six-wheel truck having a dump body. The body is provided with sideboards so that the average load hauled is about twelve tons. Four truck loads make a carload and the truck will make the round trip with a load in but little more than one hour. The truck driver loads from a 200-ton capacity bin by gravity, which requires five to ten minutes.

The talc is dumped from the truck onto a raised platform which is level with the floor of a box car. From this platform it is wheeled or shoveled into the car. Dumping directly into the car is not feasible or economical. Shipments must be made in box cars to avoid contamination of product and to prevent excessive loss in dust.

Exceptional care is taken throughout the operations to insure purity of product and absolute cleanliness and sanitation in every handling operation. Rules in this respect are very rigid and the mine is kept absolutely clean at all times.

It will be of interest to note that these talc deposits were discovered some time prior to 1910, but that production was not begun until 1915. The properties were operated intermittently from 1915 to 1921, during which latter year they were acquired by the Pacific Coast Talc Company. Later additions to the property by acquisition of adjoining claims were made a few years later, making the present area under ownership or control of the Company about 300 acres. This area covers all of the known extension of the main talc vein both directions and also covers parallel veins which have not yet been developed but which may later be productive of large tonnages.

Since 1921 the properties have been operating continuously and the entire production has been handled through the grinding plant belonging to the Company in Los Angeles. The mines are now equipped to handle 1500 to 2000 tons per month. The tonnage blocked out or developed ahead of actual mining usually amounts to about one year's requirements, which is ample to insure economical mining, and a sufficient number of working faces are available so that development work could be advanced very rapidly in event of sudden increase in tonnage required.

There is no accurate means of determining the ultimate depth to which the workable talc deposit may extend in these properties, but as the structure is pre-Cambrain and shows tendency to improve in quality and width in the lower levels, it is reasonable to expect continuation for several hundred feet below the present workings which will extend the life of the property as a producer for many years.

The rail distance from the point of shipment to Los Angeles is a little over 200 miles and cars of talc generally are delivered at the Los Angeles plant on the second day after shipment. As this time includes the local switching routine, it is considered very good freight service. The Tonapah & Tidewater Railroad connects with the Union Pacific at Crucero and the Santa Fe Railroad at Ludlow and delivery can be had in Los Angeles over either line.

The grinding plant of the Pacific Coast Talc Company is very centrally located in the east side manufacturing district on Santa Fe tracks. The plant and warehouses cover approximately 25,000 square feet, have about 200 feet of railroad trackage along side of the plant and 1000 feet of available track storage. In addition, ample truck loading facilities

are provided as a large proportion of the outgoing shipments leave the plant by truck.

The grinding plant has a capacity of 75 to 100 tons per 24 hour day, depending upon the fineness of the grind and the character of the material being handled. The plant is operated three shifts of 8 hours each, averaging about 25 days per month. The remainder of the time being taken for routine cleanup and mechanical work. The exacting requirements for uniformity of grinding and cleanliness of product necessitate great care in such detail as adjustment of grinding mill and lubrication of equipment.

The crude talc is wheeled from the railroad cars to a conveyor having an 18″ slow travelling belt. Here the talc is given a final inspection for color and quality before being crushed. The conveyor discharges to a screen having one-half inch square openings. The fines from the screen are stored and ground separately from the coarse or oversize material as repeated tests have shown that a separation at that size improves the quality of the first grade talc and at the same time produces a second product that is more suitable for certain other uses than is otherwise obtained.

All grades of talc are crushed through a Wheeling crusher, size 8 by 16 inches, then elevated to bins. From the bins through an automatic feeder to a Raymond five-roller, high-side mill. The mill is served by a 40″ fan and a six-foot cyclone separator, in a closed air circuit, so that material must remain in the mill until ground fine enough to be floated out by the air current. The cone of the separator drops the powdered talc into packer bins, while an air relief pipe from the cyclone system is connected to two tubular bag dust collectors.

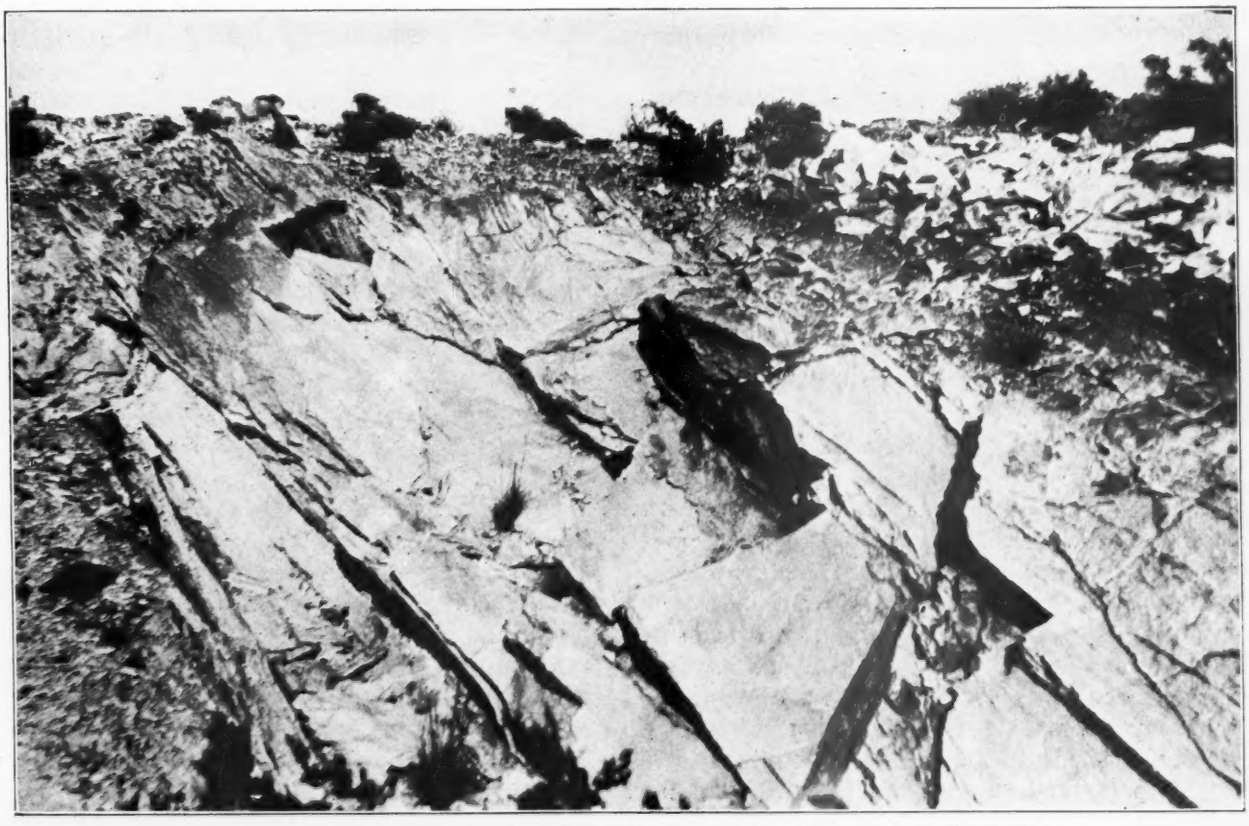
These dust collectors are so arranged that either or both may be used as desired, thus making it possible to accumulate two grades of dust without the necessity of complete cleaning of this portion of the system between runs of first and second grade talcs.

The principal portion of the packing is done with a Howe packer, though on account of the variety of bags used for different materials it is also necessary to use other packers of local design under two of the bins.

The talcs are packed in either 100, 125 or 200 pound bags, either with or without paper liners, as may be desired. Liners are used on practically all first grades and most shipments intended for ocean freight. The large bags are jute while the smaller ones are either burlap or cotton as ordered.

Very accurate control of the fineness of the grinding is essential. This is accomplished by the usual methods of adjustment of deflectors in the Raymond mill aided by certain adjustments in rate of feed and air relief which have been worked out with considerable accuracy. The fineness is checked by screening and the quality or grade is checked by color comparison and by quick acid tests every hour or oftener as may be required. For color tests at night, a special daylight test lamp is provided which is quite satisfactory.

Samples of each lot are taken as the talc is packed, these being subjected to more detailed



One of the Open Cuts on the Main Talc Vein. Note Talc Comes Right to the Surface

chemical tests and in some cases microscopic examination is also required. The microscope is provided with a specially graduated slide with cross hairs so calibrated that the size of individual grains of talc may be measured with fair accuracy down to as small as .001 inches. This is used as a check against screen sizes and to study the crystalline structure of the talcs on work where the texture or crystal character is important.

The standard of fineness for most uses to which talc is put is the 200 mesh screen, and the major portion of the grinding is 99.5 per cent through 200 mesh or finer. Coarser grinding is set at certain standard sizes represented by 75, 90 and 95 per cent through 200-mesh, while finer grinding than 200 is based on percentages through 325 mesh. Each size is designated by trade numbers such as 00, 0, 1, etc., which is a convenience to customers as well as simplifying plant adjustments.

It will be seen that there is a tendency toward complication of stock on account of several grades of talc, ground to several sizes and packed in a variety of packages, but by a system of letters and colored tags the detail of handling is not complicated. Some grades and sizes are regularly carried in stock in the Los Angeles plant and in warehouses at principal points throughout the United States, while other sizes, etc., are prepared on special order.

Many of the uses to which talc is applied are interesting and novel. The Pacific Coast Talc Company maintains a research department for development of new fields and for cooperation with customers in applying talcs for special purposes.

The highest grades of talc are prepared for manufacturers of cosmetics, talc powders, rouges, lotions and like products and for use in druggists materials. For these uses the requirements as to purity and preparation are very exacting.

In point of tonnage used, the ceramic industry is second only to the cosmetic and drug trade. Certain grades of talc are used for the manufacture of white tile of various descriptions, wall tile, floor tile, etc., both glazed and unglazed, being generally used in combination with plastic clays. For this trade the texture of the talc is specially important and the fineness of the grinding must be regulated within narrow limits.

The Pacific Coast Talc Company uses crystalline talc and certain proportions of other talcose materials from the mines for the manufacture of a product marketed under the name of Silver Crystalline Talc Concrete Admixture. This preparation is used in small amounts in cement concrete for improving the workability and fluidity of concrete mixtures and for procuring a more dense and water resistant concrete.

In concrete work a certain amount of water is required to hydrate the cement, amounting to 3½ gallons per standard sack of cement. More than this proportion must usually be used to make the mixture workable, and the excess water thus serves as a lubricant. After the concrete becomes completely set the excess water usually evaporates, leaving voids in the concrete or producing a semi-porous condition. The talc admixture, being itself water resistant and having a smooth texture serves to partly or wholly replace the lubricating water, reducing the amount of water actually required to produce a given flow in the concrete mortar, thus has the effect of making a permanently dense concrete.

For this work a distinctly crystalline talc seems essential and the grinding must be so regulated as to avoid oversized particles or an excess proportion of fine sizes. In the development of this concrete admixture and in determining the best proportions to use under various conditions of concrete work, hundreds of tests were conducted in laboratories and in actual construction work. None of the material was marketed for nearly two years after the first tests were begun, and not until the usefulness and effectiveness of the crystalline talc admixture had been proven beyond reasonable doubt.

It is sometimes difficult to convince an experienced concrete man that three pounds of this talc will have much effect upon a one-thousand pound mix of concrete, but the improved flow and the better concrete shown under almost every conceivable condition of construction readily demonstrate the peculiar lubricating effect claimed for it.

Talc enters into the manufacture and handling of rubber products to a substantial degree. The production of heat resistant materials such as fire backs, special fire brick, etc., makes use of talc, either as the sole ingredient or as a portion of a clay mixture. Crystalline talc does not change volume in measurable amounts during burning at high temperatures.

In the manufacture of paper, especially roofing and building papers the crystalline talc is said to have the advantage over fibrous talc, even though the reverse was at one time thought to be true. The explanation given by some manufacturers being that the tiny fibers have a tendency to project through the paper and are pulled out by the rolls, leaving minute holes in the paper. The grains of crystalline talc will not pull out but must be ground fine enough so that no single crystal has the diameter of the thickness of the paper.

On the other hand, the paint and varnish makers like fibrous talc or massive talc for work requiring the material to remain in suspension in oils or other liquid vehicles. Somewhat the same is true of liquid and soft polishes which are large users of talc, while in much or most of the soap trades the crystalline talc is generally used.

Talcs are extensively used in the manufacture of dry lubricants and the heavy lubricants for special purposes. The foundries use it for facing molds on some kinds of work, and the timbermen

use it to smooth the timber skids. In the production of disinfectants, cyanide preparations, orchard sprays and the like, talc is used as a filler or diluting agent as well as a carrier for the chemicals.

The commercial use of tremolite, the calcium-magnesium silicate, either as a separate ingredient or mixed with talc, seems to have developed slower than the talc and soapstone trades. At the present, however, the tremolite and tremolitic grades of talc are preferred in certain ceramic work and in the preparation of the concrete admixture. Certain specific uses are covered by patent or application for patents.

The Pacific Coast Talc Company does not handle any other talcs except those produced from their own properties. However, the company does handle for the convenience of car-lot customers a very high grade white crystalline limestone or calcite and also soapstone, mica schist and certain clays, these items representing only a minor portion of the total business. No attempt is made to produce sawn talc blocks or pencils of any kind as the material produced is not very suitable for such purposes. Another company, having properties in Inyo County, California, produces a blocky talc for this purpose and operates on an extensive scale.

The Pacific Coast Talc Company is under the active direction of Mr. George Ames, manager, a man of long experience in mine operation in the West. The mines are under the supervision of Mr. Gus Johnson. To these men great credit is due for the successful development of the properties and process of production.

Bank Deposits Increase

Bank deposits are increasing throughout the United States. Time deposits, including postal savings, plus demand deposits (but excluding government deposits) in all national banks totaled $18,239,353,000 at the opening of business July 1, according to a report just made public by Comptroller of the Currency McIntosh. This represents an increase of nearly 7 per cent over the total of the same classes of deposits a year ago.

National bank deposits have increased about 81 per cent in the ten years since 1918. In that year deposits totaled $10,029,428,000.

In the ten-year period, deposits show a decline only once, between 1920 and 1921. Deposits in the latter year dropped to $12,405,631,000 from $13,705,325,000 in 1920. It will be recalled that depression was nationwide in 1921.

There are 7,796 national banks in operation in the United States and its dependencies. Their total resources at the opening of business July 1 were $13,955,696,000, an increase of $538,022,000 over the preceding year. Paid in capital stock of the national banks now in $1,474,173,000.

Pit and Quarry of Material Benefit

O. M. Rogers, Du Page Sand and Gravel Company, writes "We are very much pleased with your publication, and believe that the larger type and larger illustrations as set forth in your publication as issued from month to month has materially enhanced the value of the paper. We look forward to the receipt of it each month with pleasure, and have found it to be of material benefit in the operation of our plant, particularly that part of your magazine which refers to plant descriptions, etc."

Industrial Activity for 1927 Best

Industrial activity this year is going at a rate slightly in excess of all previous years, including 1926, despite slackening in some lines in the last few months. This is revealed by an index of output in principal lines of manufacturing. The index begins with the year 1922 as a base and production in the following years is reported in terms of percentage of increase from the base year.

The production rate in 1923 was 31 per cent in excess of 1922. In 1924 there was a moderate decline and output was reported as 23 per cent greater than that of the base year. This was a drop of eight points from 1923 to 1924. Activity increased again in 1925 and output rose to a level of 33 per cent in excess of the base year. In 1926 there was a further increase to 37 per cent. The 1927 rate of output is 38 per cent greater than in 1922.

These percentages are valuable chiefly as showing the trend of manufacturing activity. They can be criticised when it is remembered that the production of automobiles during the first six months of 1927 was slightly below the output for the corresponding period of 1926. On the other hand textile mills show a greater activity this year than in 1926. The index must be regarded as an attempt to strike a medium for all industries.

Limestone Redeems Sandy Soil

From Oquawka, Illinois, comes the report that the sandy soil of Henderson County, which has so long been deemed worthless, is being given a series of soil improvement tests at the farm of O. E. Reason. Before the land was treated four years ago rye was raised, and seven bushels to the acre was a big crop.

The farm bureau advised a dressing of limestone and sweet clover, and last year Mr. Reason got 32 bushels of wheat to an acre, while 25 acres of sweet clover provided pasture for 50 head of cattle, 100 head of hogs and 17 work horses, and went to seed besides. That 25-acre field is in wheat this year and looks good. One thousand tons of limestone has been put on 200 acres, and there is more land to be treated.

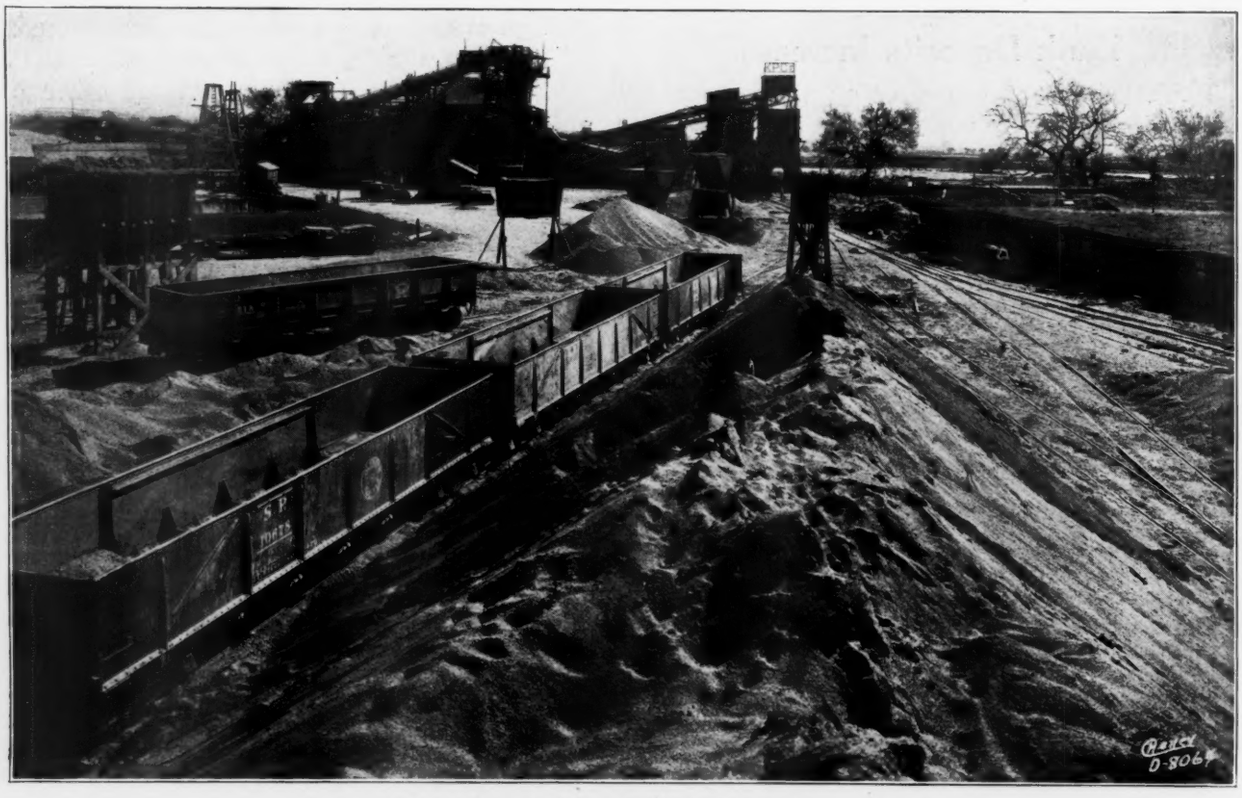
SINGLE CONTRACT STARTS GRAVEL PLANT IN BUSINESS ON PACIFIC COAST

THE plant of the Kaiser Paving Company at Livermore, California, situated on the Arroyo Mocho creek bed, was constructed in 1923, primarily to furnish gravel and sand for the construction of the Livermore Pleasanton Highway, a nine mile stretch of concrete highway, the contract for which was let to this company in the summer of 1923. However, when the plant began to operate, so much material was requested by dealers in the San Francisco bay vicinity, that the operations of the plant were continued and enlarged to meet the increasing demand for sand and gravel. The plant has been constantly enlarged so that today it has a daily output of 3,000 tons of clean washed sand, gravel and crushed rock per 8 hour shift.

The company owns an almost unlimited supply of gravel deposits, extending along the creek bed for three miles above the plant. There is a double track industrial railroad running along the creek bed from the plant to where two Koehring shovels dig the gravel from the tanks to a depth of approximately 20 feet. Over this railroad operate four to eight Plymouth locomotives, each pulling a train of four cars. These cars were made in the company's own shops and are equipped with specially constructed dump bodies. The 10 ton Plymouth locomotives are of entirely new design and are equipped with Atlas Imperial Diesel engines. These locomotives are the first Diesel powered gear driven machines made in America. The cars are pulled in and placed over an unloading hopper. The bottoms drop out, and the rich gravel deposit drops into the hopper, through a feeder, and on to the main conveyor belt where it is hoisted to the top of the plant. Here the gravel dumps into the first washer, and from this point until it leaves the loading bunkers and goes into the cars, it is constantly being sprayed and washed with clean, fresh water, from the two wells situated on the company's property. These wells supply about 4,000 gallons a minute, and when the plant is not running the water is stored in a large reservoir which can be tapped at any time.

The gravel, after hitting the first washer passes into a multitude of screens, both conical and vibrating. The bigger material, three inches and over, goes directly into a Kennedy crusher, then passes on to the crusher conveyor belt, is washed and screened and dropped into the crusher bins. When the plant is not manufacturing ballast, the material that would have been used for the ballast passes into the Symons cone 4 foot crusher and is made into a perfect inch to inch and a half crushed product.

The sand is washed and pulled from one bin to another by means of drags, and all the silt and muddy water runs off from the rear of the plant



Part of Storage System With Plant in Background

Top—View of Shops, Center—View of Garages, Bottom—View of Yard Storage System

into the creek. The gravel itself is being screened and washed continuously until the various sizes drop into their respective bunkers from the screens. More than 15 varieties of gravel, crushed rock and sand are produced, and any mix can be made that is desired. The sand drops from its bunkers on to its own conveyor belt, is passed up to the sand bunker, and cars are spotted directly underneath the bunker, from which they are loaded. The gravel is loaded on to its loading belt, receives a final screening and washing, and is then hoisted into the loading bunkers, from which it is dropped into cars by means of chutes. Large stockpiles of all kinds of material are made up to meet any demand of any size that may come up. A Brownhoist crane operated in the yard performs the stockpiling, while a standard gauge Plymouth locomotive spots and switches the cars. The spur tracks in the yard can handle as many as 150 steel cars at one time.

The gravel and sand is shipped over a wide territory. The majority goes into Oakland and San Francisco and the bay district, but material is shipped into interior points, as far south as Fresno, north to Sacramento, and material has been shipped as far east as Nevada. This plant was the pioneer in the Livermore Valley, in which five large plants are now operating. The company has its own complete repair shops, completely equipped with every kind of modern equipment, which keeps the gravel bunkers in as continuous an operation as is humanly possible.

Reads Each Issue of Pit and Quarry with Interest and Profit

J. E. Weber, secretary, the Casper Stolle Quarry and Construction Company, writes "We consider the new Pit and Quarry one of the best trade journals that come to our office and we read each issue with a great deal of interest and profit to ourselves."

Farmers Take in $12,080,000,000

Farmers of the United States earned gross income totaling approximately $12,080,000,000 in the crop year which ended July 1, 1927, the U. S. Agriculture Department announced in an official statement. This represents a decline of about 4.7 per cent in comparison with the gross of the previous year.

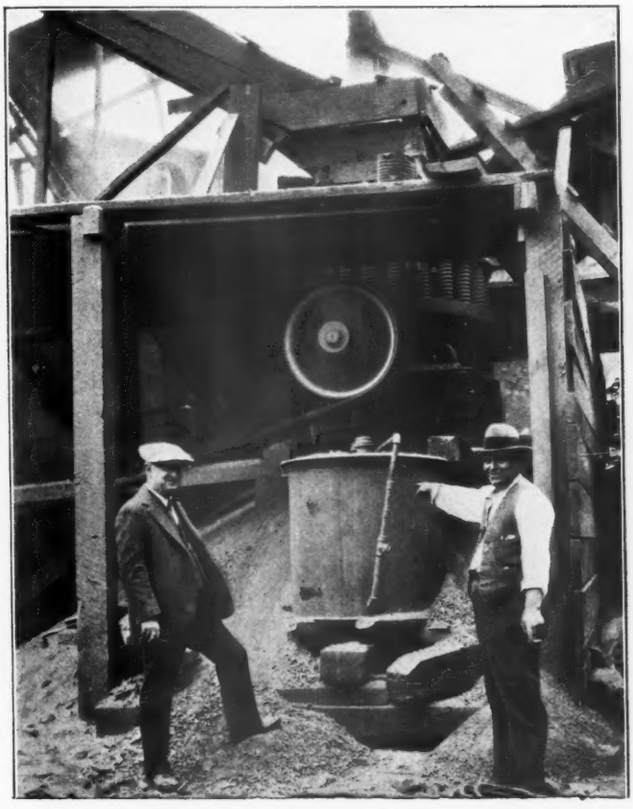
Farmers earned $12,670,000,000 in the crop year ended July 1, 1926, the department said. Earnings of 1926 were the highest in five years. In 1922 the gross amounted to $9,217,000,000 while in the following year it passed the ten billion mark and moved just beyond eleven billions in 1924. The department estimates net income for 1927 at $2,440,000,000 compared with $3,082,000,000 in the preceding year, a decline of 20 per cent. Production expenses were two per cent lower in 1927 than in 1926 it was explained. Gross income of 1927 was composed of $2,531,000,000 worth of products consumed on the farm plus $9,549,000,000 estimated to have been received in cash from sale of products.

Cars Being Loaded For Hauling to Plant

BLUE BASALT ROCK PRODUCED ECONOMICALLY BY OREGON PRODUCER

FURNISHING surface rock for the state highways from Corvallis, Oregon, to the Pacific Ocean at the rate of 40 yards an hour is the particular job of the Hammel Construction Company plant located in Benton County, Oregon, 16 miles west of Corvallis. An average capacity of approximately 45 yards of three quarter minus material has been maintained since the installation of this plant last April. From this quarry both 1½ base and ¾ minus surface rock will be furnished for new construction, surfacing and maintenance work on fifty-four miles of Oregon highway.

One of the remarkable features of this plant is that it has never been delayed by a breakdown or clogging, although the rock which is being worked is blue basalt, one of the hardest rocks in the west. The equipment used is a number 6 Champion for the primary crusher and a Symons Cone for the secondary crusher. The equipment in this plant is without equal according to Mr. M. D. Hammel of the Hammel Construction Company, especially when working in hard material. The Champion primary has never hesitated for a moment to handle the material fast enough to keep three crews of muckers in action.

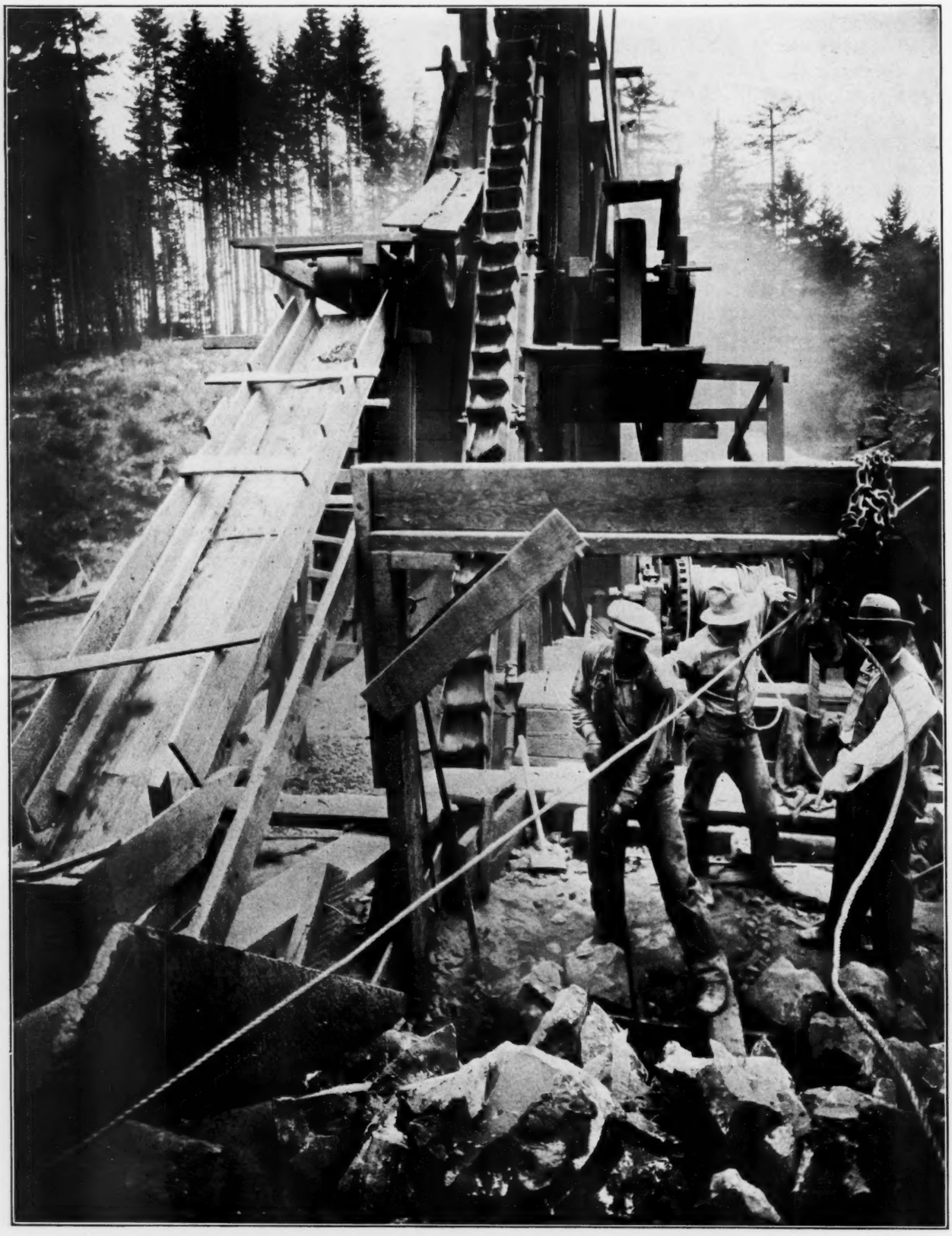


M. D. Hammel at Right Pointing to Cone Crusher

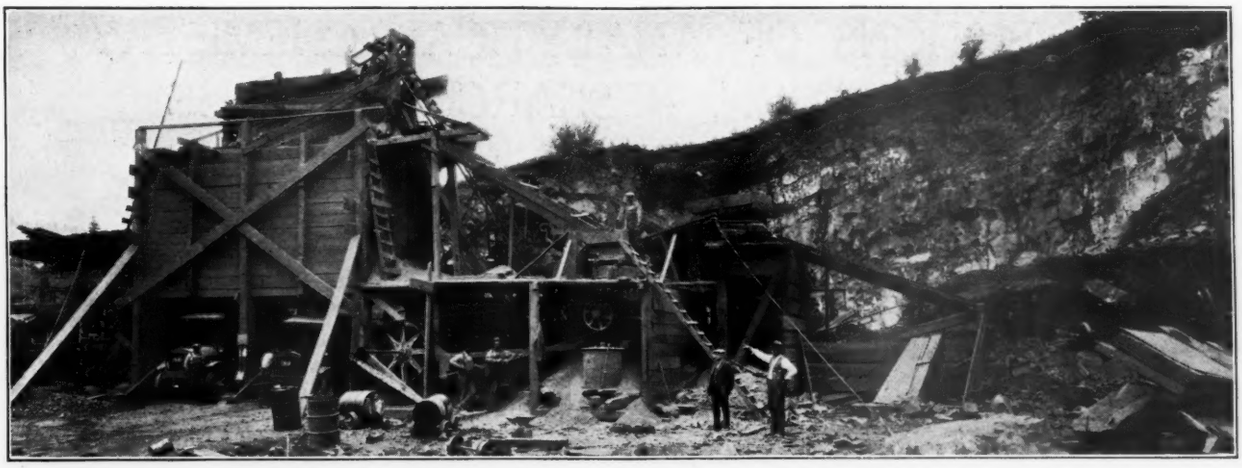
General View of Quarry and Plant

"The Symons cone crusher," said Mr. Hammel, "will handle twice the capacity of any secondary crusher we have ever used. The big springs enable it to pass tramp iron without breakage. The rapid change of adjustment without having to stop operation is very important to any operator furnishing rock to crews working on different kinds of construction. The eveness of the material which the Symons turns out has occasioned much praise from the assistant highway engineer in charge of construction."

Since installing the present plant in this quarry an increase of 186 yards a day over any former production record has been made. Although not the



Showing Size and Character of Material Going into Primary Crusher



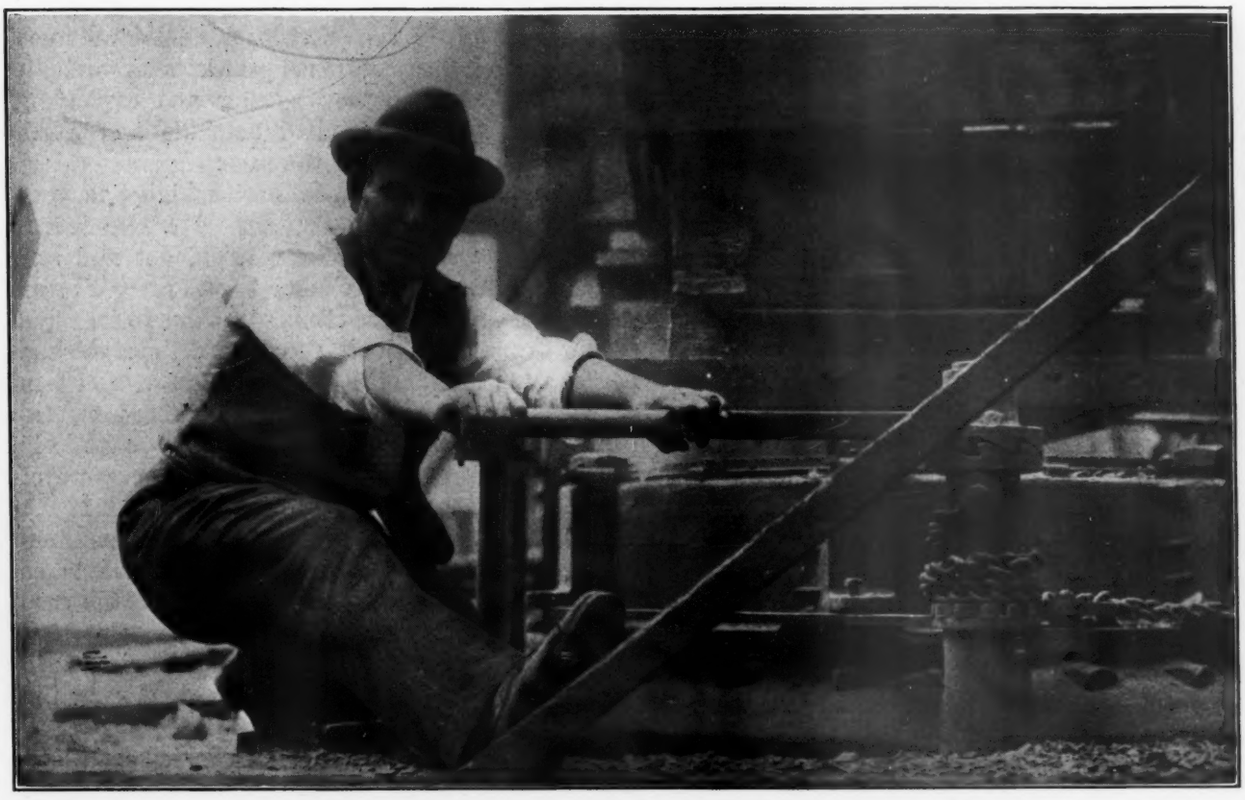
Plant of the Hammel Construction Company

largest the Hammel plant is one of the most efficient in the state.

A feature not ordinarily found in rock crushing plants is the cable lift to the feeding platform and gravity return of the car. This increase in speed of discharge and return increases the amount of material carried from the muckers by twenty per cent and also relieves the necessity of having a man follows the car. The advantages of this operation are obvious in the accompanying illustrations. Power is furnished by a 120 h.p. Fairbanks diesel engine.

The Hammel Construction Company has operated crushing plants in the Pacific Northwest for the last twelve years. The present plant with a present day shift of 40 men will add another shift soon which will about double the force. The Hammel Company is also in charge of delivering the surface rock on the road and distributing it ready for processing by the state highway construction crews.

The blue basalt produced in this quarry, which is the only hard rock quarry in the district, is particularly adaptable for the building of Oregon roads. The process used in developing a road bed that has been found to be most satisfactory in the Northwest where it has to withstand many months of rainfall consists of a heavy oiling and the continuous addition of fine crushed rock as the oil comes to the surface. M. D. Hammel is president of the Hammel Construction Company and he is very active in the management of plant details.



M. D. Hammel Showing How Cone Crusher is Adjusted to Change Size of Product

CONTRIBUTIONS OF ANALYTICAL CHEMISTRY TO PRODUCTION, RESEARCH AND USE OF PORTLAND CEMENT

By V. Rodt, Berlin-Lichterfelde*

Part II.

PART one of this treatise on the research work on Portland Cement in Germany appeared in the September 14th issue of Pit and Quarry and particularly covered the subject of production methods and research. The contributions of analytical chemistry in the use of cement are considered in the following installment.—Editor.

Michaelis put forth the contention that Portland cement on account of its large excess of lime would not be able to withstand the action of salt water, the society already at the outset of its organization devoted a great deal of attention to the question as to whether Portland cement clinker contained free lime. The problem was taken up extensively by Wagner. According to the results of his investigations, it was not possible to fix with any degree of reliability a free lime content in Portland cement, using the methods then available—The methods of Ljamin and of Fresenius. He himself undertook the estimation of free lime in Portland cement clinker by allowing carbon dioxide to act upon finely divided Portland cement clinker and determining the amount of carbon dioxide absorbed, assuming that at the temperature used 800C. only the free calcium oxide would absorb carbon dioxide. By means of this method he found about 10 per cent of free lime in Portland cement. These results, however, were already at that time declared to be impossible by Kosmann. Shortly following, Wormser and Spanger used Aluminum and Ferric chloride in alcoholic solution, Hart used Iodine in alcoholic solution, while Wormser employed ignition with ammonium oxalate. These methods were seriously objected to by Michaelis. Furthermore, the employment of solutions of sugar by Zulkowski, Heldt and Rebuffat, and heating with ammonium bromide in alcoholic solution with determination of the ammonia liberated by Brandenburg, and ignition of the cement with ammonium carbonate and determination of the carbon dioxide taken up according to the method of Passon jun did not lead to any exact results. Recently, however, it has been shown by the National Bureau of Standards that normal Portland cement does not contain any free quick lime, and that any lime present in exceptional instances can be determined by treating the cement with a twenty per cent solution of glycerine in absolute alcohol and titration of the filtrate at boiling temperature with ammonium acetate in absolute alcoholic solution with the use of phenol phthalein as an indicator according to the method of Emley. This makes possible an accurate determination. The free lime liberates ammonia from the ammonium acetate the ammonia being driven off on the boiling. The addition of ammonium acetate is continued until a coloration ceases to be produced upon further addition.

There long prevailed among cement producers the idea that the iron contained in Portland cement was present in the ferrous condition and that for this reason a clay containing ferrous iron should be used; this was, however, disproved as the result of the careful analytical researches of Goslich who showed that Portland cement, whether produced from ferrous clays by intensive burning or from non-ferrous clays by mild burning contained the bulk of iron in the ferric state.

The color of clinker due to the iron content has been made subject of numerous investigations. The brown color of clinker produced by a strongly reducing fire was ascribed by Haegermann to the formation of ferrous silicate, in addition he observed that the greenish-black particles of clinker obtained in a reducing fire contained particles of metallic iron and gave a rapidly setting and expanding cement, a content of alkali sulphide and alkali aluminate accounting for the same.

In the burning of cements with high and very low in content at 1430° C. (2606° F.) in a reducing atmosphere, Kühl, however, did not find any change of color of the clinker to yellow or brown. The discoloration of the clinker was due to its rapid cooling from the high temperature of the sintering. An explanation of the yellowish-brown color in clinker suddenly cooled from the sintering temperature was found by Kühl in that the ferric oxide in sintering clinker on account of the temperature of dissociation of the ferrites around 1600 C. (2912 F.) is partially present as such and that the combination of this ferric oxide to form ferrites takes places slowly at a lower temperature. In the case of a sudden cooling of the clinker at the sintering temperature, the ferric oxide has no opportunity to form ferrite, but remains uncombined coloring the clinker yellow to brown.

The swelling theory put forth by Michaelis lead to a series of researches on the swelling of silicic acid which at the outset were doubted very much

*From Zement, July 21, 1927, p. 615-617.

by Goslich, Gary and other investigators as the result of their observations. The swelling attributed to the taking up of water was, however, confirmed by Wagner as the result of his investigations which showed that silica in its various forms, quartz, hydrated silicic acid produced by chemical means as well as silicon dioxide produced in an anhydrous state on the treatment with lime water took up water and a certain amount of lime there being an increase in volume of several times, and, furthermore, that similar swelling phenomena are to be observed in the case of numerous silicates and especially in the case of trass. In addition swelling was observed in the case of limestone, marble, precipitated calcium carbonate, instances in which there apparently is no chemical reaction.

This problem was taken up further some years later by Cabolet. After having noticed swelling in the case of 23 cements examined by him he came to consider this as a general property of Portland cements. He found the optimum concentration of the lime water for swelling to be around 0.4 to 0.6 grams of lime per liter. Inasmuch as the cements readily give off calcium hydroxide to water this optimum lime concentration is also attained when 3.5 grams of Portland cement is shaken with 1 liter of water. The time for the occurence of swelling was highly variable with the different cements, commencing in from 1 to 84 days. In accordance with the fact that a certain concentration of the lime water was a prerequisite for this swelling, in which the volume increased several hundred times, was his observation that substances combining with the liberated calcium hydroxide such as for example sugar prevented the swelling entirely.

The study of the phenomena of swelling were in close relation to the studies of the phenomena of hardening of cement carried out by Michaelis. As the result of analytical research on the composition of Portland cement and on the products formed in the reaction with lime water, he was able to draw in his intuitive manner the most extensive conclusions in regard to the processes of hardening. He came to consider Alite, to which he ascribed the formula $(3CaO + 2SiO_2 \cdot 3CaO) + (3CaO + 2A1_2O_3 \cdot 3CaO)$. This compound according to Michaelis by the action of water gives rise to a gelatinous calcium hydro silicate and calcium hydro aluminate. From the tri calcium silicate there is at the same time split off colloidal calcium hydroxide with the evolution of heat. The jelly then forms a mineral glue which with the resultant withdrawal of water during the hardening process effects the cementing of the crystalloids and grains of sand and after the giving up of the water of swelling resulting in the hardening the product can not take up water again and soften. According to Michaelis we have in the case of the hardening an instance of the combined action of colloids and crystalloids.

The work of Michaelis has found confirmation in the observation of the formation of calcium hydroxide crystals by A. Schott in the hardening of cements rich in lime, he having succeeded in making in the crystals distinctly visible in microscopic sections.

Kanter and Dyckerhoff do not consider these swelling theories applicable to the usual hardening process in cement on account of the large amounts of lime involved which are not present in the hardening of cement under the usual conditions. Michaelis, however, maintains his swelling theory basing it upon the practical results in the field of the production of lime-sandstone and Eternite Slate.

In order to obtain an insight into the compounds which may possibly be contained in Portland cement clinker, O. Schott investigated the compounds formed on fusion of lime with silica, alumina and ferric oxide. By fusing together calcium sulphate and silica and showing that the theoretical amount of sulphuric acid was expelled by the silicic acid he was able to establish proof of the existence of calcium monosilicate, $CaO \cdot SiO_2$. This compound swelled up in water but did not show any hydraulic hardening so that it could not be of any importance as a constituent of clinker.

Dicalcium silicate, $2CaO \cdot SiO_2$ and pentacalcium disilicate, $5CaO\ 2SiO_2$ both appeared in two forms, an unstable running form of a somewhat lower specific gravity without hydraulic properties and a stable form with somewhat higher specific gravity and hydraulic properties. In the case of $5CaO \cdot 2Si0_2$ which becomes spacially stable only after keeping for several days, Schott found the expansion limit for the lime content. Schott found that the tri calcium silicate $3CaO \cdot SiO_2$ assumed by Le Chatelier to be present in clinker to be incapable of existence. Schott, however, found that with 4 to 8 per of alumina in the fusion of the $3CaO \cdot SiO_2$ non-running and hydraulically hardening products of high strength were obtained. Schott explained by means of such as alumina content the assumed existence of tri calcium silicate by Le Chatelier. The strength of $2CaO \cdot SiO_2$ was small. It rose in the case of $5CaO \cdot 2SiO_2$ and especially in the case of $5CaO \cdot 2SiO_2$ with the addition of alumina very considerably. In the case of the aluminates he also found in $5CaO \cdot 2A1_2O_3$ the maximum expansion. In the case of the mono calcium aluminate, however, in contradistinction to the corresponding mono-calcium silicate he found the greatest strength. All the aluminates set very rapidly, the rapidity of setting could be diminished neither by the addition of gypsum nor of calcium chloride. The two ferrites, $CaO \cdot Fe_2O_3$ and $2CaO \cdot Fe_3O_2$ showed but slight strength upon setting.

As already said, Alite was considered the chief consitituent of clinker already by Michaelis and

later also by Törnebohm and Schmidt, and which as the result of analysis of the purest possible material was found to be a combination of tri calcium silicate with a calcium aluminate. As the result of mineralogical researches, the observations of W. Dyckerhoff in the burning process that dicalcium silicate is formed at 1100 to 1200° C. (2012 to 2192° F.) which becomes coated with the residual melt melting at 1285° C. (2345° F.) and at this same temperature takes up about 10 per cent of lime in solid solution led him to the conclusion that dicalcium silicate which makes up about 60 per cent of the clinker is the basis of the Alite, as this is also very close to the dicalcium silicate in optical properties.

This theory based upon mineralogical findings, that Alite is a dicalcium silicate with a certain percentage of lime present in solid solution was, however, disproved by Kühl and Schmidt by the analytical results at hand according to which in the case of a prevalence of dicalcium silicate in addition to the aluminates and ferrites richest in lime, a high percentage of free lime would be present in Portland cement. Another factor according to Kühl against the theory of Dyckerhoff is the absence of the typical tesseral crystals of the calcium aluminates in sections of clinker, the property of running peculiar to the dicalcium silicate, its slight strength, the always encountered alumina content in alite and the uniform etching of the alite crystals in old extensively hydrated clinker. Accordingly, according to Kühl alite must be considered as a compound of lime, silicic acid and alumina of a somewhat varying composition as is often the case with solid solutions and isomorphus mixtures. As the result of his researches, Jänecke ascribed to alite the formula $8CaO \cdot 2SiO_2 \cdot Al_2O_3$.

As the result of the petrographical researches of Törnebohm there were present in clinker four mineral constituents to which he gave the names alite, belite, celite and felite respectively. These could be defined optically. Chemically, however, they could not be well defined owing to the impossibility of a close separation. The three first named were considered to be calcium aluminum silicates, celite having a certain iron content, while the composition of felite remained unascertained. The chief result of this research was, however, the recognition that the calcium aluminates and calcium silicates contained in clinker are not present separately but are found as mixed crystals in the form of calcium aluminum silicates.

By means of the specific staining methods of Keisermann and Blumenthal by means of organic dyestuffs (anthrapurpurin, patent blue and methylene blue) it was possible to fix, at least qualitatively, the individual constituents in the hydration of clinker and numerous researches of a microscopic nature on this plan have been carried out by numerous investigators such as Muth, Ambronn and v. Glasenapp in order to elucidate the chemical nature.

As hydrolytic decomposition products resulting upon the treatment of Portland cement with a large amount of water there have been found: Calcium hydroxide which first appears and later crystallises in hexagonal plates and columns, then colloidal calcium hydro silicate which separates in drops and a half liquid gel of calcium aluminate which has a tendency later to go over into the crystalline form (forming, according to Kühl, small octahedra sphaero-crystals). According to the researches of Thüring, Kühl, Desch, Berl and Urban it is extremely probable that the hydration products are mono calcium hydro silicate ($CaO \cdot SiO_2 \cdot + x\ H_2O$, tetra calcium hydro aluminate, $4CaO \cdot Al_2O_3 + 12H_2O$, and calcium hydroxide. All calcium aluminates including the ones rich in lime, according to the observations of this investigator on hydration with excess of lime water give only tetra calcium hydroaluminate which can also be obtained synthetically by mixing aqueous solutions of calcium hydroxide and hydrated alumina, it being the sole reaction product in this case.

Accordingly the original views of Michaelis on the hardening process have been confirmed by the results of later research, except as far as the gel formation is concerned, which Kühl has shown to be due to the separation of a series of slightly soluble transposition products from a supersaturated solution and not to the swelling of an insoluble sediment as was assumed by Michaelis. The setting process corresponds to the gelatinisation of the originally colloidal solution of the calcium hydro silicate which is in accordance with the disappearance of the water in the setting cement.

Kühl has also distinctly emphasized the fact that these hydration products formed by the action of relatively large amounts of water upon cement can not be detected in cement masses made up and hardened in the customary manner. He, and v. Glasenapp before him were able to discern in sections of normally hardened Portland cement only the slightest indications of crystal formation by means of diffusion and illumination in polarized light besides the bulk of mass consisting of an undifferentiated gray mass of an amorphous gel-like structure.

All the beautiful studies on the hydration of clinker are, therefore, not directly applicable to the normally occuring hardening of cement and it remains as a problem for the future to discover methods of investigation which will allow the study of the formation of the hydrated calcium silicates and aluminates under conditions as close as possible to those prevailing in the production of dry mixtures. For these purposes the study designated by Tippmann as micrurgy will no doubt furnish good results in the future, this method comprising work with finely constructed instruments.

FIXING ACCIDENT RESPONSIBILITY

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FIXING accident responsibility is a most serious problem. It calls for a decision, which, under any circumstances, is hard to make; one which must be carefully studied, and only a cool, clear, unbiased opinion is to be used in handing it down. The safety movement, as we know it today, particularly in the cement industry, is really an innovation compared to the age of the industry. The year 1919 saw the beginning of extensive accident prevention work by the Portland Cement Association, and, while there were a good many individual plants and companies which paid particular attention to the prevention of accidents before that date, yet, nationwide attention to accidents began in that year. Attention to accidents means placing the responsibility on the party directly responsible for them. Little or no attempt was made to fix accident responsibility in years previous to 1919:

It might not be amiss to state here that the first day I started with a cement company there was an accident at the plant which resulted in a fatality, but, to be honest, perhaps through inexperience, or youth, or both, it did not make the impression that an accident does today. I do not recall any attempt to fix accident responsibility in the first years of my work. The general attitude in the cement industry was to take an accident, serious or otherwise, with a shrug of the shoulders, as if it had to be, or, as if it were part of the routine operation of the plant or quarry.

There are four headings into which "Fixing Accident Responsibility" can be classified:

(1) Executive or company policy.
(2) Plant Manager or superintendent.
(3) Plant Safety Committee.
(4) The individual.

(1) It is a well-known fact that the attitude of the superior officer or executive, president or board manager, or whatever individual or group directs the policies of an organization, is reflected down to the humblest employee. If this individual, or group of individuals, is not squarely behind the welfare of the employees, and does not sanction safety work, it has a bearing on results secured by the company. This might be termed more pyschological than actual, and, therefore, a president could hardly be accused of being the cause of an accident. However, careful analysis shows that he is responsible to a much greater degree than a casual glance first discloses. The mere fact that most individuals and groups look up to leaders for initiative is sufficient cause for the statement that the executive is responsible in a certain measure, for accidents if he, or they, are indifferent to the safety movement.

It is inconceivable that an executive of today is not squarely and actively behind the safety movement. There are some who are passive, though, and such should certainly be held liable for at least part of the responsibility of the accidents occurring in their organizations.

(2) The second party on whom the responsibility of accidents rests, is the plant manager, or superintendent. In a great measure, the entire success of the safety work depends on him. If safety is not being pushed energetically, or, as in some few cases, is not even considered, then this man is directly responsible, except, perhaps, in the rare case where his good intentions are held in abeyance through the orders or wishes of his superiors. A good plant manager includes the safety movement as part of his daily duty. I say daily because safety work is largely missionary work, and the true safety man can be likened to a missionary who toils unceasingly, day after day, without any thought of reward, gratified entirely, through love of his work, with but small visible results. He must be a keen student of human nature. His interest must never lag. He must be able to put across the idea of safety, not only to the safety committee, which should be directly under his supervision, but also able to put the idea across to the individual, through his actions and speech.

The following case occurred during the war period. The common labor at the plant was composed mostly of rag, tag and bob-tail which had escaped the draft, and more negro than white. During a particularly rainy period, with the coal storage low, it was necessary to put a force of laborers shoveling from the coal pile into the screw conveyor under the coal trestle. This screw conveyor was guarded with a heavy bar grating, bolted down to the concrete. The plant superintendent was in this particular department for some little time, principally with the intention of putting across the safety idea to these men, as several serious accidents in screw conveyors had occurred prior to this time. No sooner had the superintendent left the storage, than one of the negroes removed the grating, straddled it, and started to shovel in coal.

He slipped, fell in the screw, but miraculously, had only the flesh and muscles of the calf torn, instead of losing his entire leg. While he lay on the stretcher waiting for the doctor, the superintendent asked him why he did it, and he was frank enough to admit that he wanted to hurry his work up, that

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is, fill the coal tanks over the boilers, and then sit down and rest, which is characteristic of the negro as you know. This accident brought the superintendent face to face with placing the responsibility, and he felt guilty because he did not have the ability to read human nature better, or else was unable to sell an idea, and, from that time on, this superintendent became a bettery safety man. The injured man was not censured at the time. He was suffering enough pain without giving him mental stress in the bargain; but on his return from the hospital, coming back to work, he became one of the best safety men in the plant. Perhaps you have all had similar experiences, and the plant executive who is unable to strike the chord of safety, and cannot sell or put across the idea of safety, lacks one of the fundamental characteristics which will make him a success.

(3) It is no easy task to have a safety committee function properly. In the early beginning, when safety committees were first organized, while it was not the rule, yet a good many plants had safety committee in name only. This committee might be composed of any number of men, meetings would be called at various irregular intervals. Sometimes the members of the committee were "too busy," having a small repair job to work on, and considered the operation of the mill of more importance than the safety committee meeting. Again, the spirit of the organization would be dominated by the plant executive because he took it upon himself to turn down all recommendations except those which he himself might bring before the committee, feeling that an employee was "treading on his toes," or presuming beyond his station, or overstepping his authority. In other words, the safety committee was not being handled right by the plant executive. A good executive will have a good safety committee, and this is the third group upon which the responsibility for accidents rests. It is not right for a superintendent to take upon himself the duties of a safety committee, so to speak, nor to inspect the plant at such times as he may see fit, perhaps with one member of the safety committee or alone, nor to install certain safety devices and consider good safety work being done. Such practice, in reality, is nothing but the result of egotism on the part of the superintendent.

A manufacturing plant as large as the average cement plant today needs a safety committee that consists of not less than six, and ten is considered approximately the right number for a three thousand barrel plant. The committee itself must be made up of real safety men, whose enthusiasm must be ever to the front. The members of the committee should not necessarily be chosen by the superintendent, as the employees know best who of their number is most interested in safety work. The committee should meet at regular intervals, and, in addition, have special meetings when the occasion demands, such as a serious accident, and it is only right to place in its hands the fixing of accident responsibility.

A man does not have to be college bred to make a good safety man, but he should be one of sound sense, a thinker, and have a good understanding of the idiosyncrasies of human nature, coupled with unflagging interest and endless patience. When all of these characteristics are found in one man, he is a jewel well worth keeping and generally demonstrates his worth through the results obtained. However, it is not difficult to find many of these characteristics in the average plant employee. If the safety committee is properly organized, and has the shining example of a good superintendent, it is bound to function efficiently.

The accident records of the Portland Cement Association show that there are a "vicious few" plants which apparently lack something to bring their safety records to at least normal, and this record of the few pulls down the record of the majority through an excessively large number of man hours lost on account of various kinds of accidents. On the other hand, there are a number of plants which have an enviable safety record. A major portion of the success of this record can be traced directly to the safety committees.

It will not do to appoint a safety committee and then, on the day or days specified for the regular meetings, permit its members not to attend on account of some breakdown in the mill, or other excuse which might be forthcoming; or, on the other hand to cancel the meeting until the next day, or the day after, as the superintendent may have something which he considers needs his attention. There should be, as stated before, a specified time for the meetings and the schedule should be adhered to, and, except for unforeseen, serious reasons, no member should be allowed to be absent. If there are one or two members who would rather not attend, it is usually an indication of lack of interest, and they should be removed without further consideration, and others appointed in their places.

Neither should the plant superintendent, through the authority vested in him, become a jury of one and veto valuable suggestions uffered by various members of the committee, merely because they might not strike him as the right move. If the suggestion is approved by a majority vote of the committee, unless he questions it at the time it is discussed and gives reasons sufficient to vote it down, the resolution should be placed on the books and the work done as suggested. Too often a peremptory veto takes the pep or enthusiasm away from the committee, and this, in turn, is reflected throughout the organization. With what result? Either there is an increase in accidents or a fail-

ure to obtain results in periods when drives are put on, such as the recent campaign of the cement industry in June of this year. Accidents in the plants can be reduced if the safety committee is functioning properly, under a good executive. If they are not reduced after the organization is started, then it must assume its share of blame for all accidents, major or minor, which occur, for it has failed to do its duty, which is, first, putting across the safety idea to fellow employees, and, second, providing the good example.

No doubt some of you have observed members of your own safety committees doing foolhardy things in the plant, or making disparaging remarks in the presence of other employees. If these failings are not corrected after a heart-to-heart talk, they should be dismissed from the committee and the fact published throughout the plant, which, as a rule, is sufficient punishment and makes them better safety men. Sometimes one hesitates to use the big stick, but it is necessary with certain types. It is rather difficult, perhaps, to cite cases where safety committees have flagrantly violated their duties. Actually, the idea of the formation of the safety committee originated from the fact that the plant executive cannot reach each individual throughout the plant; not coming into daily contact with as many of them as the members of the committee do, and on its shoulders rests the responsibility, which is very heavy. If this idea is instilled into the minds of its members, there is no doubt that the committee will never be censured nor taken to account for accidents which might occur.

(4) Fourth and last comes the individual himself. Except in catastrophies, where many are injured, and some killed, it is the individual who is generally responsible for the accident, and that responsibility must rest on his shoulders. Only, however, after a thorough investigation. If the plant superintendent is a safety man, and his safety committee is working properly, the injured employee has had an opportunity, through observation of the actions of his fellow workers, and discussion with them, to learn about the safety movement and has been instructed regarding all hazards about the plant. If he does not benefit through these methods he is entirely to blame.

There are certain individuals who seem to be unlucky and who are continually unfortunate. In one particular case it was necessary to discharge the man. He would be injured, and, a day or two after his return to work, he would have another accident. Within the course of a year he suffered ten accidents, not quite one a month. It was finally decided that he was too great a risk and he was let go. Such is an unusual condition, however.

These comprise the four headings into which responsibility for accidents can be classified, but they are only one side of the subject. There is another side, which some people have emphasized, that is, the sentimental. It is not the intention to take that up in this paper as sentiment should not be used in handling safety matters. The only sentiment which enters into the situation is this; the man, or men who are responsible for an accident, and on whom the responsibility is placed, are usually punished sufficiently through the knowledge that they are the cause of pain and monetary loss to a fellow being, and further punishment should not be meted out, except in cases of gross carelessness, other than the publishing of the fact that they were directly responsible for the accident. That is as far as sentiment should be considered in handling this matter. Nor should generosity be considered in placing the responsibility.

There is one type of accident which cannot be accounted for even after a thorough investigation, and the responsibility for such accidents cannot be placed on anyone's shoulders. Particular reference is made to a fatality experienced at a cement plant in 1926 when one man was electrocuted and two others severely shocked while pulling on a cable from a car puller. These men were in the packing department and it was their duty, in connection with packing cement, to unroll the cable from the drum of the car puller, attach it to the last car of the string, and, after this hook was attached, pull the cars in front of the packing house door. These three men took hold of the cable, after starting up the motor of the car puller; two of them were knocked ten feet, one unconscious and the other severely bruised, but the third, presumably from a weak heart, was electrocuted.

Just who should be held responsible for this death is still a question. Starting at the top, the president of the company is a safety man; the superintendent has been giving, and continues to give, all there is in him to have an excellent record at his plant; his safety committee is composed of good safety men, and the general attitude of the whole organization of the plant places it in the front ranks of the safety movement. A thorough investigation of this electrocution brought forth the fact that it was caused by a faulty electrical connection. The first deduction would be that the plant electrician, who, incidentally, is a hearty worker on the safety committee, was responsible, but, if this conclusion is reached, why should not the plant executive take his share of the blame, or, going higher, why should not the head of the operating department, or even the president be implicated? To place the responsibility on any of those individuals would be wrong, because the motor received regular inspection, and the short circuit, which was the cause, evidently happened shortly after the motor was inspected, without giving any sign of happening at that time, and it could have happened the first time the machine was started up after it was inspected. It would, therefore, be most unfair to place the re-

sponsibility of that accident on the shoulders of any one individual.

Another fatality which a cement company recently experienced, happened to a young foreigner while stripping in the quarry. He was excavating in a pocket. A large stone suddenly slipped out of the bank. Close inspection failed to disclose the possibility of this stone moving. It fell against the man's leg, breaking it above the knee. He was removed to the hospital and the bone was set and the leg placed in a plaster cast. Examination several days later showed that the set was broken. An operation was performed, but the man died from strombosis or blood clot. Perhaps the quarry foreman should be blamed for this accident in that he did not detect the loose stone at the location where the man was injured. We all know that careful inspection does not always disclose defects, and the company feels that this man is not to be blamed for the original accident. Being a muscular fellow, the doctor claimed, was the cause of the original set being broken, and they had every reason to believe he would survive the operation. Strombosis is apt to happen to anyone undergoing an operation, however slight, where blood vessels and arteries are cut. On just whose shoulders the responsibility for this fatality should rest is a difficult problem to solve, but the doctor came in for censure, perhaps unfairly. Numerous cases where it is difficult to place the responsibility even after a most thorough and careful examination, could be cited.

There is another type of accident which occurs frequently in cement plants, which is to be most heartily condemned, that is, accidents caused through "horse-play." The responsibility can invariably be placed on one or several men, and those men should first be given a fair chance to stop the practice, and if they do not heed the warning, dismissal is called for. One reads and hears of so many horrible results such as those of ruptured intestines through the application of compressed air, or, electrification of the drinking cup, which caused the death of an employee who had a weak heart, and, while meant as a joke, such practice can be called nothing but horse-play and should not be tolerated. This is one of the few cases where accident responsibility is easily placed, and the person condemned should not be given much consideration.

I had occasion to discuss safety with an officer of the cement companies some time ago, and remember distinctly his making the remark that he had not been pushing safety work as he should in that year, and the record of his company was much worse than in previous years. This I took as an indication of his thoughts on the matter and have watched the record of that company from that time on, and the results obtained by it have been truly remarkable. In fact, it is now near the head of the list in the length of time during which no accidents have occurred at their various plants, where before this record gave anything but a good impression.

If all executives have safety work at heart it would do worlds of good in reducing the number of accidents in their plants, for every individual would be proud of the fact that he was doing his little bit to have a good safety record, and one of his reasons for this satisfaction is the knowledge that his superior officer is keeping a close check on the plant's accident record.

On the other hand, there are numerous cases where safety work comes from the heart of every one concerned, from the president to the humblest employee, yet the accident records are deplorable. The records at the various plants where this is a fact will go along unblemished for months at a time, except for an occasional scratched finger or other minor-no-lost-time accident, and then, suddenly be spoiled by a fatal accident.

I have in mind one plant in particular which would build up a wonderful record; all the members of the safety committee and the organization as a whole were on their toes to make the record 100 per cent for a year at least, when, out of a clear sky a fatality would occur; for instance, an electrocution where a man stepped from the crane girders down to the bucket and touched the trolley cables. Part of the craneway did not have a roof over it and it was raining at the time of the accident. That he neglected to shut off the current on the trolley cables before he went to repair the bucket, was assumed. The man was worked over for hours, but without result. A year went by with a very good record before another accident occurred. This was the electrocution previously mention, where a man was killed when pulling the cable on the electric carpuller. About twelve months later, an employee working in the basement of the silos, in crawling over a screw conveyor which was three feet above the floor, got caught in the screw, tearing his leg out at the hip. The man died shortly thereafter.

Such accidents as these can be enumerated indefinitely, although the general trend is toward reduction. Various methods are tried in an effort to overcome and reduce them to a minimum. Placing the responsibility for such accidents has been gone into in this paper. It is poor practice, however, to close the door after the horse is stolen, and the best way to prevent waste of time, trouble, and perhaps hard feelings due to placing accident responsibility, is to prevent accidents, or, to close the door of the stable before the horse is stolen, and this can only be done through unceasing effort on the part of every one, or, in plain words, constant missionary work.

Grade crossing fatalities have increased from 1,791 in 1920 to 2,492 in 1926. This annual loss of life can and should be curbed.

WHAT VALUE A SUPERINTENDENT ANSWERED BY LARGE PACIFIC COAST QUARRY

By Gordon F. Sondraker

THE quarry operated by the Hauser Construction Company of Long Beach, California, is perhaps the major operation of its kind on the Pacific Coast. Slightly over a year ago the Hauser Construction Company was awarded the contract for the construction of the Long Beach breakwater which called for a total of almost two million tons of granite in various sizes, over a period of two years time. As the Hauser Construction Company has had long experience in this type of work and have proven to their satisfaction that it is far more economical to produce the rock than purchase it, they immediately set out in search of a suitable deposit of a high grade granite.

After some search by Mr. K. B. Kumpe, General Manager, and Robert Gordon, General Superintendent of the corporation, they were fortunate enough to locate and purchase a deposit of excellent quality granite averaging 170 pounds per cubic foot. This deposit is located approximately 5 miles west of Riverside and 50 miles east of Long Beach.

Unusual View Showing Operation of Hauser Construction Company

Superintendent Gordon immediately set about making preparations for handling this immense tonnage and shortly thereafter had a crew of 214 men driving tunnels, stripping the proposed quarry face, building bunk houses, offices, machinery buildings, etc. Today, Superintendent Gordon is operating a quarry face one-half mile in length and rising to a miximum height of 320 feet above the quarry floor. In addition to the remarkably fine quarry face Superintendent Gordon has already developed he has so arranged his development program so that at any time in the future he can open up an additional half mile of quarry face if it is so needed. Some idea of the tremendous size of the operation can be gathered from the photograph shown above.

The writer has had the good fortune to visit many of the large quarries on the Pacific Coast, but for economy in operation and ease of handling the material he must certainly bow to Superintendent Gordon for the way he has developed this quarry.

Three 50 B-Bucyrus steam shovels are loading direct from the quarry floor to flat cars. These shovels are using fuel oil as fuel and are served by both water and fuel from pipes underlying the entire quarry floor. The water and fuel being under pressure at all times. A short metallic bound hose leads from the valves on the water and fuel pipe lines direct to the shovels. This arrangement as developed by Superintendent Gordon and his able staff has obviated any delays in refueling and taking on water. To obtain the maximum results from the smallest investment possible the shovels are operated two eight hour shifts commencing at 7:30 a. m. and 5:30 p. m., respectively. The night shift operates by the light of numerous electric flare lights.

The shovels were first started with standard 1¾ yard capacity buckets but it was soon found that while this type of bucket was ideal for smaller sized material it did not handle the larger pieces of granite successfully, thus necessitating a large amount of sling and cable work. Superintendent Gordon collaborating with the Bucyrus Company soon developed a rather different type bucket with what is styled a Vanderhoff front. This front allows the shovel to pick up all save the largest pieces of material and carry them successfully from the quarry floor to the cars. The material handled varies from fines to 15-ton pieces. The larger size pieces are more desired for their work so one can readily see the saving in both time and money the development of this type shovel has produced. The records as kept by Mr. Gordon prove that this type bucket has given a production averaging three 50-ton cars per day to each shovel over the former type used.

The three shovels have been in operation over two years on this and other projects of the Hauser Construction Company according to Superintendent Gordon have given very satisfactory service.

The daily production will average ninety 50-ton cars or two solid train loads. To assure a supply of cars on hand at all times the Hauser Construction Company leased 450 flat cars from the Union

Pacific Railway Company. Of this amount a minimum of 130 cars are kept on hand at the quarry at all times. Car stakes and sidings are furnished by the Hauser Construction Company.

Two 70-ton switch engines were purchased from the Union Pacific Railway Company by the Hauser Construction Company and are used in switching cars both on the quarry floor and in the yards. Fuel oil for the switch engines and shovels is stored in a tank of three car capacity situated adjacent to the compressor building and machine shop. This fuel oil is purchased very cheaply from the nearby oil fields and refineries.

A complete machine shop is maintained to care for any repairs on any of the equipment. Included in this machine shop are two drill forges and one Sullivan class A drill sharpener with a capacity of 250 drills per hour. Although only about 700 drills are sharpened daily, Superintendent Gordon has deemed it wise to provide the extra capacity in case of sudden need or an extra large amount of development work being necessary.

A stock of three different sized drills are maintained and sharpened as needed. The 7/8 inch size for "block holding," the 1 inch for driving tunnels and the 1¼ inch for "up and down holes."

The writer was escorted through the machine shops and compressor rooms by "Oly" the compressor man. The main compressor equipment consists of two double stage Ingersoll Rand air compressors with a capacity of 610 cubic feet at 100 pounds pressure. These two compressors are driven by two 100 h.p. Westinghouse motors.

As auxiliary equipment, three Ingersoll Rand Imperial—14 portable compressors are maintained. One of these portable compressors is "Oly's" especial pride, he having had it in service under his care for Hauser Construction Company since 1920 and as "Oly" expresses it, "she never missed a lick from that date to this." These compressors have a capacity of 210 cubic feet each.

Through the courtesy of Mr. Lamb, Office Manager and Harry Heath, Paymaster, the writer was shown through the offices, boarding and bunk houses. By the way it might be wise to mention the fact that according to Mr. Gordon, Harry Heath has been with the Hauser Construction Company so long that he is referred to as Mr. Hauser. With his little joke Mr. Gordon also informed the writer in a rather more serious way that he would be lost without Mr. Heath as he had been with him and aided him in all the trials and tribulations that surround a quarry operators life. The camp is completely equipped with sleeping accommodations for seventy-five men with boarding house facilities for one hundred and twenty. A majority of the employees, especially those with families live in Riverside, about five miles distant.

Several seemingly unimportant items were revealed during the writer's inspection of the quarry and his conversation with Superintendent Gordon. When asked what was his greatest problem when starting the operation, Mr. Gordon gave the surprising answer of, "Chickens." When pressed for further details, Mr. Gordon explained that when operations were first started considerable opposition was shown by poultrymen whose small ranches are adjacent to the quarry; their opposition being based on the belief that blasting at the quarry would interfere with the incubation of eggs. Superintendent Gordon immediately in his characteristic way installed an incubator with several settings of eggs immediately adjoining his compressor house and delegated to "Oly," the compressor man, the official title of poultryman for the Hauser Construction Company. Needless to say, Mr. Gordon's experiment in the chicken business met with very happy results as he not only had remarkably fine results from the eggs incubated but he also quieted the fears of the surrounding poultry ranchers. Another example of Mr. Gordon's ingenuity concerns the water question, both domestic and for use in the shops, on the shovels and the locomotives.

When Mr. Gordon first arrived at the scene of operations he was faced with the need of a water system. Two wells were drilled on the property but to insure a constant supply of water at all times a reservoir was needed. After surveying the situation, Mr. Gordon leased an abandoned orange packing house with a large concrete celler. A small expenditure for patching gave him a fine reservoir at a very small fraction of the cost necessary to construct one.

This article is assuming the proportions of a biography of one individual. But after careful inspection of what Mr. Gordon has accomplished, the many economies of operation he has devised, the loyalty of his employees and his own self-effacement, there is only one conclusion to reach and that is that the present state of efficiency in which this quarry is operated is not due primarily to good machinery and good workmen but to one man alone and that is Superintendent Robert Gordon.

Pit and Quarry Highly Commended

J. D. Hartman, manager, Calcium Products Company, writes "The transformation which you have brought about in the make up of Pit and Quarry magazine as it is now issued is to be very highly commended. Your technical articles which have appeared from time to time are certainly very interesting and useful. The writer has heard recently many very favorable criticisms on the present high standard of your magazine, setting forth as it so clearly does, the cooperative effort of practically all of the operatives of our very important industries. You are certainly to be congratulated on the high order of your photographic reproductions."

SAFE HANDLING OF ROCK

By Areli Jones
Superintendent Indiana Limestone Company*

ROCK quarries are as many and as varied as the ships that sail the seas. A rock quarry is a place where they get out rock of any description, whether it be road rock, shale, stratified rock, or the more substantial building rock commonly known as granite, marble, sandstone or limestone. In the quarrying of building stone, all conditions of hazards are very similar. It has only been in the last two years that the quarries of southern Indiana have taken any real interest in safety problems, which confront every quarry operation, large or small, and whether it be road rock or building rock.

Just as long as men are indifferent we will have accidents to contend with. Why do some men get hurt in the quarries more often than others? Possibly for the same reason that some men have more automobile accidents than others. We are trying every day and every hour to solve the problem of automobile accidents, because it affects the life of every one of us. We believe the only remedy or solution is an education in safe methods, regardless of the few seconds we lose at the stop signs. We must bring order out of chaos by learning to obey all signs and signals—stop at the highway and the railway crossings; when in doubt proceed with caution. With an education in safe methods of driving the subconscious mind will assert itself, regardless of the surroundings and the humdrum of life. That little substation within you will automatically control the breakers of the mind, breaking contract at stops and red lights.

Education is the key to progress. If we do not learn to control our actions, then the State must step in and find out how much we don't know about safe methods of running a car—just as a trainman must know the rules of the road, and just as we know that when a train crew disobeys the rules of railroading something is going to happen. Education in safe methods has reduced accidents on railways and in many industrial plants. Why not seek to attain the same result in rock quarries?

To my knowledge, the first concerted effort to establish safety principles in the stone quarries of Indiana were put forth by the Bedford Stone Club with the assistance of The Travelers Insurance Company. This campaign was started August 1, 1925, and was personally managed and conducted by M. J. Morgan, who was then president of the club. He was ably assisted by E. C. Walters, secretary of the Stone Club.

Committees were organized in each plant, men who could be relied upon were picked for the committees, and an enormous amount of literature was passed out setting forth the advantages of safe methods. True, we agreed with the disaffected employee that it was an advantage to the company, but we pointed out that it was even a greater advantage in a saving to the worker and his family. Posters of many designs, with which all of you are familiar were posted, more ably illustrating the point—possibly more forcibly than the pamphlets could do. Noonday meetings were held in each plant, speakers on safety were secured; night meetings were held in the public school buildings; the men and their families were invited to these meetings; local singers entertained all present with the singing of safety songs, many of which were original, thus adding a little spice to the movement; safety slides were used showing the operation and the progress made in other industrial plants; safety engineers were also introduced, who instructed us in the safe methods they had used and the success attained. I do not doubt that there are some men at this Congress, who remember an evening spent in Bedford or Bloomington, Indiana; and thus it was we inbibed the "Spirit of Safety."

This intensive campaign terminated with a successful issue August 14, 1925. We were all tired out, but felt the message had been put across. Future events proved this to be a fact, regardless of some of the raw material we had to contend with. For our supply of men came from the farms, many of them from the mountain fastnesses of old Kentucky—men who had heard of the law, but the word "Safety" was not in their vocabulary, men who would go about their work on the ledge with the utmost abandon when a large block of stone was swinging overhead, weighing an average of fifteen tons, and as these blocks in swinging over might cast a shadow at their feet, it was received with no more concern than a passing cloud. These men realized no danger.

Yet with a foundation so well laid, it was up to each plant, each mill, each ledge, in the quarry district to contribute its part to the building of this safety structure according to the approved plans and specifications. True, there were spots where the pioneering was rough, the brush and thicket had grown dense and was hard to penetrate, and instead of the bountified yield as produced on limestone soil, it seemed that some of the seed was smothered by the dense growth of previous years. Transplanting had to be done, and the records prove that it was done successfully. I was interested at that time with the Indiana Quarries Company, which was one of a group of quarries working in-

*Presented Before the Quarry Section, National Safety Congress, September 28, 1927.

directly through the Stone Club, which sponsored this safety movement.

After the campaign, and under the direction of N. Joyner, general superintendent of the Indiana Quarries Company, we proceeded to form our plant organizations, by first electing a Board of Directors composed of 12 men, all of whom held an official position with the company. This board then picked men from the different departments, whom they considered capable of doing the committee work, because of their influence and the boosting capacity. After all the committees were organized, we began holding joint meetings of all committees one might every week, exclusive of the regular department meetings. Board meetings were held once a month. It was our desire to keep up the pep previously created, and to get thoroughly organized, so as to inculcate the lessons and principles of safety just as fast as the men might be able to absorb them. Continued interest was shown by the committees and the men, safety became a real issue and foremen took as much interest in safety as production. I have no comparison of records to show what was accomplished in such a short space of time, but I do know this. The Indiana Quarries Company carried its own insurance, and it was more than pleased at the saving made in the insurance budget up until June, 1926, when the Indiana Limestone Company absorbed the Indiana Quarries Company.

After the merging of the quarries, Fred Hatfield was appointed safety engineer, and with his able assistants, Nevin Tovey and Wm. French, a trio of earnest and zealous workers, was enlisted, a combination that is bound to win and bring about the safe handling of rock in the quarries, which of itself is a big proposition, not so much because of the number of men employed and the various branches of industry in connection with it, but because of the scattered condition of the quarries and ledges.

One does not realize the territory that must be covered by the safety engineer. If you have never been down in southern Indiana the trip is worth while, as you pass through a country of wonderful scenic beauty. As a safety suggestion, be sure your brakes are tested before you make the trip, because you will encounter wonderful hills, with long, graceful curves and some that will be rather abrupt and winding around the hillside.

Each hill or combination of hills is composed of rock that has withstood the ravages of the glacial period and the washing and pounding of many waters, when the southern part of Indiana was covered at one time with a body of water similar to Lake Michigan. If you visit Orange county you will see a lost river which drops into the ground and disappears from the eye of man, perhaps fashioning out some cave for future generations to discover. Then we have Marengo cave with its spacious halls, rooms and passageways, all washed and worn out with the irresistible force of some previous lost river. Such are the surroundings of the Indiana limestone quarries, a stone almost identical in texture and analysis with the stone of the Pyramids of Egypt.

After a prospective stone quarry has been located and tested, it may be necessary to cut off the timber, after which the hydraulic machine is set up. This water power will certainly remove all the clay, dirt and roots of trees, leaving a nice clean ledge to work on, sometimes level, sometimes exceedingly rough and jagged, resembling very much the rock bound coast of the sea. Many and varied are the ledges of rock. Sometimes merchantable stone lies just under the surface; after cleaning off the light soil, the track can then be laid on the ledge.

The machines are set to work cutting out the rock, and the derrick is raised. Several kinds of machines are used, each with some special feature or improvement over the other, if the limestone rock does not extend to the top of the ledge. Then we have the Mitchell rock to contend with; this may extend down five to twenty feet. There are times when this could profitably be taken out and used for road rock. Taking off the top rock is an expensive and more or less dangerous proposition, because of the rough nature of the stone and the work. Blasting is done where possible, all depending upon the formation of the rock. Accidents occur. Men have tried to thaw out dynamite on the hearth of the blacksmith shop; men have used drills to remove the tamping because of a misfire, drilled too deep and set off the explosive, with the usual result; men have left powder can open and exposed to sparks—of course the inevitable happened, because a safety law was violated; some individual decides to climb up on the pile of rock just blasted out, only to step on and release an over balanced rock, causing a slide which if not disastrous to himself may be to others. Sometimes big grout, blocks weighing five or six tons, are set on the pinnacle of the grout pile, and some one is there to release the dogs and tip the blocks over to their everlasting resting place—a hazardous job, and a man who knows how should fill that job, as a trap is very easily set, and when sprung, a slide may extend up to the pinnacle and jeopardize the life of the tripper. So much for the stripping of rock.

In getting back to our channelling machines, now that the rock stripping is complete, sections of track are laid on the floor of the ledge, similar to the laying of railway track, except that the track is fitted up in sections and fastened together with rods and braces, then laid together end to end. The track is then leveled up with blocks of woods, so that the machine can run true. The channel drill bits are clamped on the machines, the machine travels up and down the track striking a blow from the piston. Some other machines work on a leverage basis. The machine runner sits at the throttle, the fireman throws in the coal and looks after the

water. If he happens to be standing with one foot on the rail when the machine runs back, and the fireman forgets his foot is on the rail—well, he is liable to lose half of his foot, or at least, some toes. Men have sat on their machines and kept them running until they went over the edge of the ledge into an abandoned quarry hole from the previous year's work, falling perhaps a distance of 50 feet. Men have stopped their machines under the same conditions at the edge of the ledge to tighten up a nut, the wrench slipped off the nut and the pull on the wrench was toward the quarry hole, with the result that some one again went over the ledge into the quarry hole. It seemed to be just a case of luck, as to how serious he was hurt. Dump boxes of coal have been set down on the upper ledge, only to slide over on some one working on the ledge below. And so we could go on enumerating accident after acident. Was the machine at fault. Only the human machine slipped a cog. So we are thoughtless, careless, and indifferent to danger. Safeguarding machinery is worth while, and money is well spent, not so much because it makes the machine fool proof, but because of the object lesson to the man employed. It is a continual reminder of safety.

To me it is not so much the safe handling of rock at the quarries as it is the safe handling of men. There are some unavoidable accidents, but with the education of the human element accidents are bound to decrease. I wish to repeat that a foreman should feel obligated to his employers for the safety of his men, if not from the human viewpoint, than from the economic standpoint. Why not cut down this economic loss, reduce the cost of production, which would be equal to about one cent per cubic foot? And yet, a greater obligation, owed to your fellow workmen, to his wife and children, to your employers and to humanity at large, is the protection of your men in every conceivable way. Safety comes first.

If you, as a foreman, have been elevated from the ranks because you have shown foresight and skill in the handling of rock, you are to be congratulated; but there are a number of tests for qualifications as a foreman. Do you believe in safety? Have you been taught that accidents decrease production and increase costs? Are you interested in the welfare of your men? Are you treating your men as you would like to be treated? In so far as you treat them on the square and show appreciation of their efforts, have you succeeded in winning the confidence of your men? This alone proves the highest type of foremanship. Someone has said, "Give no man your confidence until you have found him worthy." So, to be worthy of the confidence of your men is something worth while, and proves that you have passed the acid test. Men are just overgrown boys, and we don't have to go back very far to remember the days when we moved in a new neighborhood, or some kid moved in our neighborhood. We or he had to meet the test whereby we or he gained, or lost, the confidence of the gang. You men here tonight have passed that test also, or you would not be here, because the boy is father to the man.

To handle rock safely in the quarries, there must be leadership. Not such a big word, and yet true leadership spells success in every walk of life. Leadership at the quarries runs from the executive office down into and through every department. Out on the ledge a one track mind cannot lead. Just as the derrick runner is capable of taking up on the boom hoisting up on the mainfall and swinging the rock around into position on the car, all three operations at the same time, accomplishing a three-fold purpose, so it is with the foreman; he must have at least a three track mind—the condition and security of his machinery, the safety of his men, the production of rock. Are the powers bolted down securely? Are the derricks and guy-ropes safe? Has he taken time to take up the slack on the guys, and keep the mast plumb? How about that fall rope with its strands of broken wire? Does he know the limit of its endurance? Does he make inspections regularly, or just previous to heavy lifts? Has he instructed his men in regard to the relative position of the boom when dragging in cuts or making lifts of various loads? Are the chains and dogs, cables and slings in good condition? Are the ladders in good shape. Are the steps made standard so that the men can use a regulation step in climbing up and down the various ledges?

For the safety of his men, is he insisting that the men on the ledge keep out from under loads that are being hoisted and swung around overhead, even though the men are running machines and producing rock? It is dangerous practice to allow men to remain on machines when loads are passing over. Get away from the old idea that men can be replaced along with machinery. A machine can be replaced in one day to one week's time; a man's life can never be replaced, and if crippled, he can never be made new like a machine. And, remember, it takes two to four years to make a capable man in the quarries. As with machinery, so with the men, does he know where they are weak? Does he know the man capable of the heavy job? Does he know the man capable of the hazardous job? Know your men. Remember, there is no group of workmen capable of perfect co-ordination in themselves. The powerman must change gears on the derrick hoist, so must the foreman change his men to suit existing conditions.

Then comes production. This I am putting last, because in a well organized department it comes last. It is a natural result of previous preparation. As acting foreman or superintendent, I have never

thought of my work in terms of production. I rather like the plan, and combine things to work together. I do not wish to sacrifice material, just to get out some certain size blocks today. I believe in preparation, just as the athlete, who expects to win in the fight, whether it be in the ring, in the channel swim or on the field of sports. There must be preparation and it must needs be the proper preparation, if you are to get results. So it is with the farmer and the gardner, preparation comes first, then follows the production of crops. Some of you can remember when your mother or some one else's mother, made bread; perhaps you had been invited by your chum on baking day to come in and get a nice big crust of fresh, hot bread covered with butter and honey. Upon your arrival, the bread was just being taken from the oven, and right there all your anticipated joys and pleasures were blasted. An accident had happened; the bread had fallen flat; production had fallen to a minimum in that household, because something was overlooked in the preparation.

So it is with the drilling and breaking of blocks that have a rather mean grain. If proper preparation has not been made to take care of the adverse grain, the break in the block may run under and below the line, and again we lose in production.

The Indiana Limestone Company owns 6,600 acres of land in Monroe and Lawrence counties, and in order that you may realize the magnitude of their operations and the responsibility of the safety engineer, I will add that they operate 220 channelling machines, both steam and electric, 200 derricks, some of steel and some of Oregon fir, all operated by electric power; 12 hydraulic stripping pumps with a capacity of 500 to 1,000 gallons per minute. They operate their own machine shop, boiler and forging shops, heat-treating system, acetylene and arc welding outfits, the electrical department doing all their own rewinding and repairs, carrying 75 machinists, electricians and mechanics. Also operating in the quarries, we have seven lime kilns shipping out 60 tons of lime each day.

In addition to the quarry operations, the safety engineers also supervise the safety work in the mills and stone planing shops; these are a part of the Indiana Limestone Company. So that you may get some idea of the extent of their work in the mills, I will name over the machines in operation: 101 traveling cranes, 243 gang saws, 287 planing machines, 8 diamond drag saws, 38 diamond circular saws (for ripping stone), 64 diamond circular saws (for jointing stone), 9 large column lathes, 39 baluster lathes, 29 milling machines, 4 carborundum planing and molding machines, and 5 surface and polishing machines. The company anticipates a 12,000,000 cubic feet production this year from the quarry department based on figures of previous years. Indications are that we shall beat the schedule set by one million feet or more. I am wondering to what extent safe methods have helped to increase this production.

Our short experience in safety work has taught us that education in sane and safe methods gives a man self-reliance, helps him to stand on his own feet, and create a feeling of responsibility in that the life of other men may depend on his actions. Safety education brings to a man the realization that he is capable of taking care of himself; also gives him the ability to control what otherwise might become a dangerous proposition. He will develop a keen insight as to what might prove dangerous and, if not able to control it, report to those in authority. Such a man, instead of being a liability, becomes an asset to his department, his employer and his home. As I understand it, these are the ideals safety engineers seek to attain.

Automobile Manufacturing Influence

The extent to which the automobile manufacturing industry influences some other lines of business is seen, according to the National Automobile Chamber of Commerce, in data prepared by that association which is intended to show the proportions of total American output of raw materials that are consumed by the 52 principal motor car making plants of the United States.

Fifty per cent of all of the plate glass manufactured in the United States is used by the auto industry, according to the chamber. Fourteen per cent of all the finished rolled iron and steel produced in the country goes into motor cars and trucks, it is announced.

Of some other materials, the chamber reports the following proportions of total United States production consumed by the automobile industry: crude rubber imports 85 per cent, upholstery leather output 63 per cent, nickel 28 per cent, aluminum 25 per cent, copper 13 per cent and hardwood lumber 11 per cent.

In addition to the above materials, the auto industry also employs large quantities of softwood lumber, upholstery cloth, paint and varnish, hair and padding, tin, lead, and zinc. An increase in sales and production of automobiles thus benefits many other principal industries, the data of the chamber would indicate.

More than 10,000 deaths from highway accidents in 1926 were the fault of pedestrians, declared the American Road Builders' Association in a bulletin on highway safety. In addition to this number approximately 6,000 pedestrians were killed as a result of careless and discourteous conduct on the part of motorists.

USE OF MINERAL FERTILIZERS EMPHASIZED BY KAWEAH QUARRIES ON PACIFIC COAST

FOR the past twelve years the Kaweah Quarries has been operating in the famous San Joaquin Valley of California, manufacturing a finely pulverized limestone used for agriculture, as fines for asphaltic paving mixtures and for increasing the density of concrete pipe and water proofing concrete basements. About five years ago an added industry was the establishment of a mixed fertilizer plant manufacturing what is known as Pennewell's Mineral Compost, and now the mixed line is being increased and a number of combinations are projected with ground limestone as the carirer for the so-called complete fertilizers.

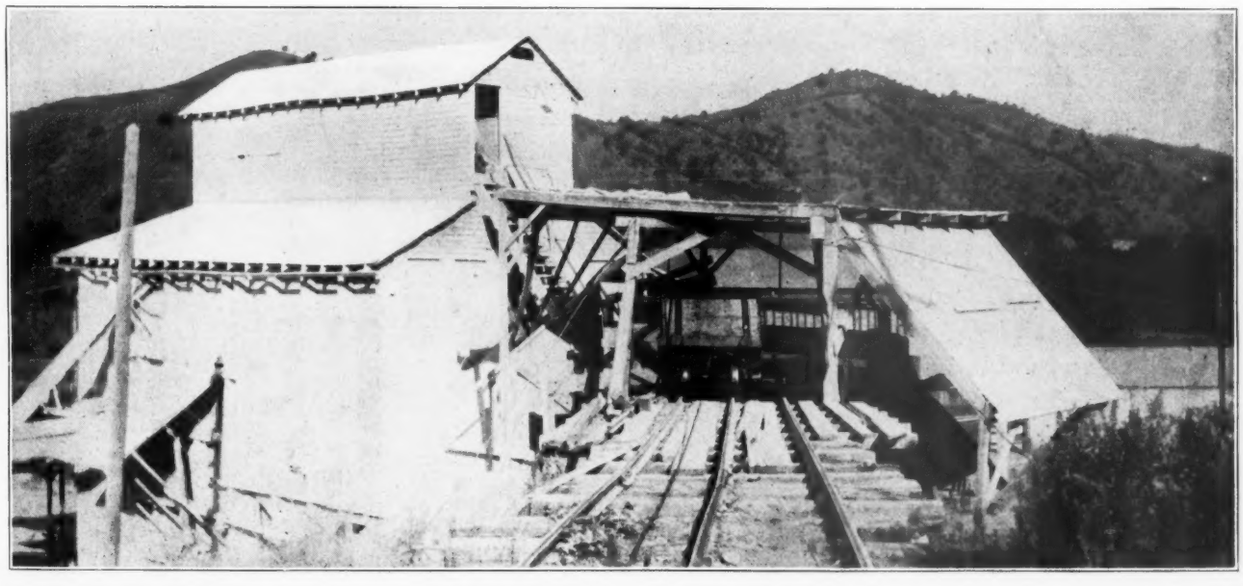
The deposit of limestone that is quarried lies southwest of Fresno about sixty miles and covers nearly 370 acres in the foot hills of the high Sierras, being thirty miles west of the national park known as Giant Forest, the home of five thousand Giant Sequoias, including General Sherman tree, "the oldest living thing in the world," estimated as 7000 years. It's height is 280 feet, it's base diameter 39 feet, 8 inches and at 100 feet above the ground its diameter is 17 feet, 7 inches.

The quarries are located seventy-five feet above the plant and the transportation of the quarry cars is by a three-rail train. The operation is by sheaves and cable and the loaded cars return the empties to the quarry floor. The loaded cars are automatically dumped into the primary crusher at the plant.

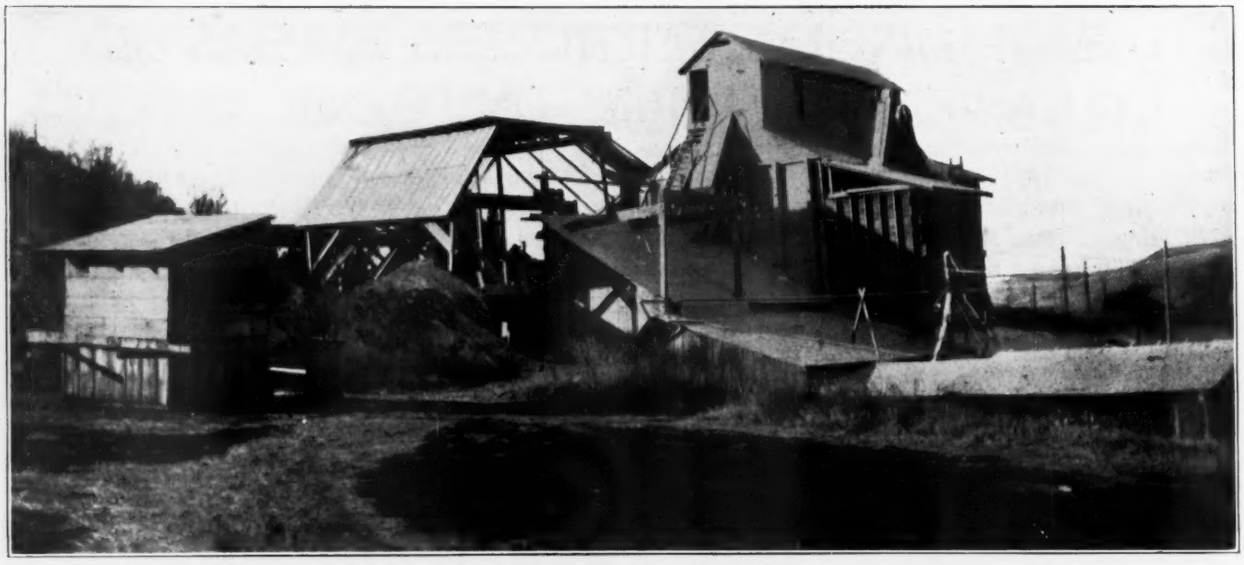
The limestone is high calcium and averages 95 per cent calcium carbonate. While the property has never been core drilled, competent geologists have estimated from fifteen to twenty million tons of rock. The present quarry has a face of 70 feet high by 200 feet in length and the face will rise to about 350 feet in height and a thousand feet in length in the process of excavation.

The quarry was originally opened in 1874 and the stone was calcined. Many of the old buildings in Visalia, Hanford and Fresno were plastered with the product. This industry lasted for a number of years but was abandoned twenty years ago and the quarry laid idle until purchased by the present owner in 1915. The present plant was started in that year and put in operation in March, 1916, and has been operated continuously since that time under the present direction.

The quarried product is fed by gravity from the cars to a number 5 Gates crusher and is broken to two and one-quarter inches. It is then passed over a shaking screen with one inch holes, the oversize going to a number 3 Austin gyratory crusher set at three-quarter inches. The combined product of the screens and Austin is elevated to a 350 ton bin under which are located four Griffin mills that are fed by gravity from this bin. The mills are so arranged that each can be engaged as a unit or all four at one time. These mills are the finished product plant and they produce a pulverized limestone for the agricultural trade of 60 per cent through 200 mesh screen and for the other consumers of 78 to 82 per cent through 200. The mills average better than two tons per hour each of the agricultural size and 1.5 tons per hour of the paving dust group. From the grinding units the finished product is elevated to a hopper that is arranged to discharge to three separate con-



View of Crushing Plant Showing Discharge Platform



East Side View of Main Plant

veyors for sacking and piling, and to storage bins or railway cars for the bulk shipments.

The plant buildings, as shown in the illustrations are the main buildings wherein are located the crushers, bins and pulverizers and are all on the tracks of the Southern Pacific, V. E. branch. In another illustration is shown the sacked goods warehouse which is 100 by 40 feet. In this building a stock of from 10,000 to 20,000 sacks of 100 pounds each are carried. There is also a sack warehouse where the sacks are stored and repaird. A second warehouse 65 by 35 feet is used for the storage of sacked paving dust and there is a bulk material bin 42 by 20 by 25 feet which holds 1000 tons of material. This bin is connected by a screw conveyor to the elevators in the fertilizer mixing plant and warehouse, and in this latter building are the bins for limestone. Phosphate, limestone and sulphur, are the three minerals used in the Pennewell Mineral Compost, the formula of this being 1500 pounds of limestone, 400 pounds of ground rock phosphate and 100 pounds of ground sulphur.

The limestone is sacked on scales of the company's own design and the principal operation is sacking, weighing and loading in the freight cars direct. Jute or cotton bags are used in this work. In the fertilizer department a four-valve Bates packer and multiple Bates paper sacks are used. The equipment of the fertilizer department includes a car unloader and a mixing unit which is an old

View of Quarry Giving Excellent Study of Rock

style Foote continuous concrete mixer, together with screw conveyors, elevators and four motors.

The entire plant has a total energy of 312 h.p. The power being 3 phase, 60 cycle, 440 volt, and the motors operating as follows: The Sullivan compressor, etc. at quarry are operated by a 100 h.p. Fairbanks-Morse and one 5 h.p. Fairbanks-Morse operates the electric hoist. The crushers and two Griffin mills are operated with a 100 h.p. Westinghouse. Two of the Griffins have each a 30 h.p. Fairbanks-Morse. The conveyors and elevators use four motors—one of 10 h.p., two of 3 h.p. and one 7½ h.p., all Fairbanks-Morse.

The mixer and apparatus at the fertilizer department use four motors, all Fairbanks with 30 h.p. total.

The location of this plant is about the center of the San Joaquin Valley which is two hundred and fifty miles long and from sixty to one hundred and fifty miles wide. This is the great orchard valley of California and is one of the most intensively cultivated bodies of land in the United States, famous for its fruit and dairy products. This is the only fertilizing plant in northern California in this great trade territory. There are many large deposits of limestone in the mountains of California but very few within reach of rail transportation, the nearest one to the plant on the southeast being one hundred and fifty miles and the nearest on the northwest one hundred and thirty-five miles.

Agstone has not had its just application in this state and is in an embryotic condition. The use of mineral fertilizer is in its infancy yet and the growth has been slow but every year has shown an increase and the past year was by far the best in the plant's history. It is believed that if other producers of agstone would get their products in the fertilizer class by making the mixtures outlined above, particularly a lime sulphur mixture, that the cumulative effect would be to increase the general use of agstone. Prices could be made so reasonable to the farmers that the use of agstone would be greatly increased. There is apparently no sound reason why ground limestone or sulphate of lime should not be the principal component of all the mixed fertilizers.

The operations of this plant have been continuous for the past three years and most of the time the plant has been operated in two nine hour shifts. The quarry and the tram are flood lighted and there has been no difficulty in the operations from weather conditions materially interfering with the production. At present the capacity output is assured for the next six months as the State Highway Department is engaged in putting an asphaltic concrete top on the old four inch concrete roads that were built from the proceeds of the first bond issues. The specifications for this work call for from 8 to 10 per cent of paving dust and this will mean that several thousand tons will be used each year until about 1100 miles of this old type road is improved. The original roads were paved 15 feet wide but they are being widened to 20 and 24 feet and topped with the asphaltic concrete.

There is no contention for coarse ground limestone or screenings in the use of agstone here. The applications are never less than two tons to the acre and some of the citrus soil experts recommend as

Quarry View Showing Formation

high as five tons every four years to their patrons, and they all want material so ground that results will be given in the first year. Land that sells from $750 to $2,500 per acre must produce and there is a condition of acidity in most of the orchards from the use of acid fertilizers that must be overcome to warrant these prices. The operations are under the direction of A. C. Root, the owner, and the plant is known as the "Kaweah Quarries."

Effective Simplicity in Plant Layout Carried Out in This Plant

The Hawkeye Fuel Company operates a neat and efficient sand and gravel plant out in Spokane, Washington. Material is brought into a grizzly by a 2½ yard Bagley scraper operated by a 75 h.p. electric hoist. The material passes by gravity to a 48 inch by 10 feet scalping screen which is divided into three sections with the first and second sections interchangeable to conform to the size of material required, while the third section has 3½ inch perforations.

All material passing through the perforations in the first and second sections is delivered to a 20 inch belt conveyor that delivers to a scrubber, a distance of about 400 feet. All material passing through the third section is delivered to a number 3 Telsmith crusher. All material passing out through the end of the screen goes to a 27 inch Traylor jaw crusher.

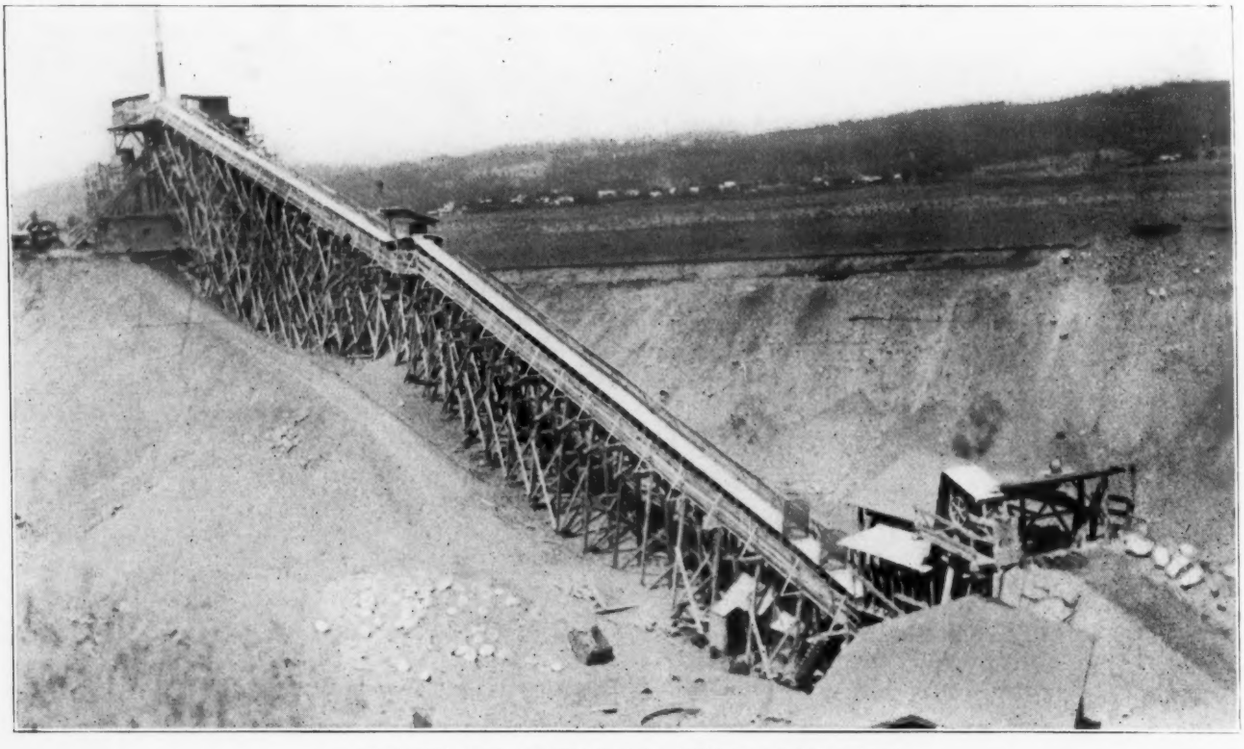
The discharge from both crushers drops to a 20 inch belt conveyor that delivers to a bucket elevator thirty feet high, which delivers the material back to the grizzly. A 75 h.p. motor supplies the power for the two crushers, scalping screen, bucket elevator, and conveyor.

The scrubber is a rotary screen 48 inches by 12 feet. The perforations are of a size to remove excess amounts of small aggregates, torpedo sand and clay which is wasted through a 10 inch water pipe. After the gravel passes through the scrubber it is delivered to another screen, where it has its final washing. It is then spouted to its respective bin, from which it is loaded to cars by gravity. Water for washing purposes is supplied by a De Laval centrifugal pump from a shallow well near the river. This pump delivers 700 gallons per minute to a height of 112 feet. Power is supplied by a 25 h.p. motor.

The officers of the Hawkeye Fuel Company include J. S. Ramage, president; Le Roy Gillogby, vice president, and W. R. Ramage. The sand and gravel operations represent a simple and efficient layout representing a careful expenditure of capital.

New Road Policy in Japan

It is reported that the Home Department of Japan has decided to introduce a radical change in the road policy pursued by the previous cabinet. A conference was held recently at the Department to discuss the subject and the general outlines of the new road policy were laid down. In building new roads or in rebuilding old ones, much importance has hither been attached to their statistical value, but the new policy is said to have a special regard for their value from the point of view of promoting industrial developments.



Sand and Gravel Plant of the Hawkeye Fuel Company

CRUSHERS AND THEIR COMPONENT PARTS

Wm. T. W. Miller

Part VII

PARTS one to six, inclusive, of this series of twelve articles, have appeared in the past six numbers of Pit and Quarry. In them Mr. Miller described mechanisms applied to jaw crushers, jaws and check plates for rock crushers, toggles and toggle bearings, lubrication and the development of the gyratory crusher. In the seventh article, which begins below, Mr. Miller continues the subject of the development of the gyratory crusher.

Mr. Miller, the author of this series, has had thirty years experience as a specialist in crushing machinery. For the last twenty-six years he has been employed by Hadfields, Ltd., of Sheffield, England. For the past eighteen years he has been in charge of their crushing machinery department. He has studied crushing problems in the United States, Canada, Brazil, Uruguay, Argentine, France, Spain and Portugal.—Editor.

Bearings and Suspension Systems for Gyratory Crushers

The main-shaft carrying the crushing cone in all true gyratory breakers is supported at its upper and lower ends, the upper bearing is situated in the bore of the spider bridging over the feed-opening and the lower forms part of the eccentric which applies the force for the crushing operations to the bottom end of the shaft. The thrust collars sustaining the weight of the shaft and head are, in most cases, incorporated in the spider-bearing and the suspended shaft has practically displaced the older form which was supported on a foot-step in the base-plate.

The spider-bearing therefore has a double duty to perform in that it provides a pillow-block to bear the reaction from the crushing pressure which falls at this end of the shaft, and includes a base-ring or spherical seating to carry the entire weight of the spindle and cone plus that part of the breaking strain which is transmitted as downward thrust due to the conical shape of the head. Before proceeding to examine the various designs for the spider-bearing it is advisable to emphasize the fact that the main shaft does not rotate in the strict sense of the word and if it does revolve slightly under the crushing action it may move in the contrary direction to the revolution of the eccentric.

For many years the Gates Iron Works made their gyratory crushers with supported shafts and the height of the crushing cone was regulated by the raising or lowering of a lighter screw and toe-step let into the bottom cover which pressed against a hardened washer in the bottom end of the shaft. This left the spider-bushing free from any adjusting mechanism and the bearing consisted of a cast iron bush pressed into the spider-boss as shown in Fig. 1.

It is necessary to bear in mind that the shaft gyrated about a fulcrum instead of revolving on a fixed axis and that the fulcrum was situated in line with or near to the lower end of the bush, the result being that the eccentric travel reversed above and below the neutral center. To allow for this reverse gyratory movement the upper end of the shaft, which rested in the bush, was made slightly taper, the conicity being sufficient to ensure that a straight line contact was obtained on the pressure side of the bearing, the bush itself being parallel in the bore.

Although this bearing would seem to be crude and inefficient it is wonderfully effective in service and no change in the principle of working has ever been seriously considered so far as the writer is aware. It will be noted that all the illustrations embody the same feature and utilize the same form of bearing for resisting the beam-reaction from the main-shaft, the variations in design being brought about by changes in details to suit the different methods of suspending the shaft.

The Gates Iron Works designed and tested several contrivances for suspending the spindle at its upper end, but, for a long time, they were chary of adopting any of these systems in place of the well-tried toe-step. Fig. 2, illustrates one of their early efforts in this direction, a heavy cover-plate or false flange was rigidly attached to the top of the shaft by means of a powerful screw, and the under-surface of this flange was made part-spherical where it found a bearing on a prepared seating inside the upper part of the spider-bush. This bush, made in steel, was extended upwards beyond the seating for the flange and was threaded internally to receive a screwed cover which ended in a projecting bolt passing through a capor washer-plate resting on a ledge formed inside the top of the spider-boss.

In this mechanism the fulcrum-point of the shaft was situated at or near the lower end of the bush, the cap or false-flange attached to the top of the shaft had a slight sliding motion due to the reverse gyratory action but this radiated from the fulcrum as a center. By means of the bolt-cover screwed into its upper end the bush could be raised or lowered and the vertical position of shaft, cone, and fulcrum point changed accordingly. It was claimed for this mechanism that it maintained a

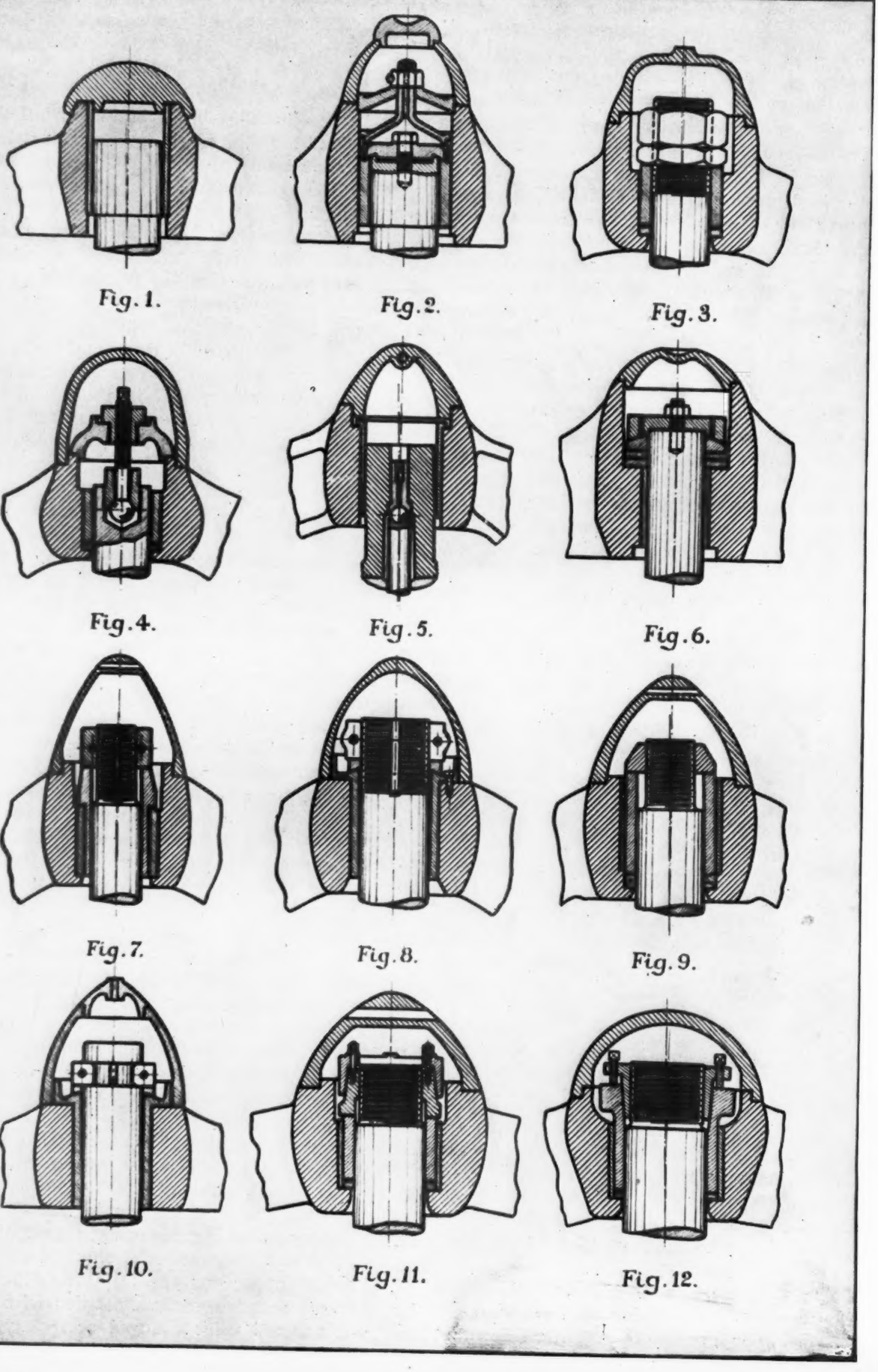


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

constant distance between the fulcrum and the crushing head and that the true spherical movement on the trust-collar ensured an even bearing over the full contact area at this point.

The McCully Company would appear to have been quickly convinced of the merits of the suspended shaft as compared with the supported type and from the first they strongly advocated its use. About 1892 this company patented two contrivances for suspending gyratory shafts and these are indicated in Figs. 3 and 4. Fig. 3, illustrates the system which, in principle, has been very generally adopted, a sleeve was fitted over the upper part of the shaft, this sleeve was parallel inside but slightly tapering outside to conform to the angle of gyration. In the figure no renewable bush is shown in the bore of the spider but this was added later to compensate for wear. The shaft was prolonged above the sleeve for a sufficient distance so that nuts could be screwed down and made to bear on the top end of the sleeve.

When the shaft was in its working position the lower end of the sleeve rested on a hard steel wearing ring laid on the flange formed at the bottom of the hole in the spider Owing to the angular position of the shaft and the fact that at no part of the stroke was its center-line truly vertical, the lower end of the sleeve was never in contact with the thrust-ring over any considerable area. When the bedding faces were coned to correspond to the angle of gyration the theoretical bearing could only be equal to line contact.

There is frequently some misapprehension regarding the action between the lower end of the sleeve and the upper face of the thrust-ring. There is no rising and falling movement lifting the shaft, the fulcrum point remains stationary whilst the line contact rolls around it completing one circle of movement for each gyration of the shaft.

Although this contrivance was open to criticism, from the standpoint that the contact area was too limited to satisfactorily bear the weight, the fact that it has survived through many years of hard usage is sufficient proof that, correctly designed and made in proper materials, it is well able to meet the working conditions. It is therefore a notable coincidence that, in many instances, this upper gyratory bearing depends on line-contact for the proper carrying out of its dual functions, withstanding the side pressure, and resisting the downward thrust.

Little need be said with regard to the mechanism illustrated in Fig. 4, the shaft is hung on a spherical-headed bolt which passes through a plug screwed into the top end of the shaft and is continued through an arched cover-plate which is recessed to receive the nut on the hanger bolt. Owing to the gyratory motion at the end of the shaft it was necessary to provide some freedom for side-movement for both nut and bolt. It is doubtful whether this mechanism was used to any serious extent as McCully confined his attention to the alternative construction shown in Fig. 3, with slight changes in detail.

Fig. 5 illustrates the Hadfield system for supporting the main shaft, this was introduced about 1899 with the object of reducing the friction due to the side-movement on the toe-step bearing as used in the Style "D" Gates crushers. The main shaft was hollow-bored and an inner shaft passed through the hole from an adjusting screw in the bottom cover to the single phospher-bronze ball centered at the fulcrum point. By this means support was provided at the neutral center and all side-movement was eliminated. This method of supporting the shaft proved entirely satisfactory under the most arduous conditions.

Fig. 6 shows a later design by the Gates Iron Works which appeared about 1893. This retained the cap or false-flange attached to the top of the shaft by means of a stud-bolt, it also embodied the spherical bearing-surfaces for the thrust-collar and cap, the radial lines springing from the fulcrum of the shaft so that a complete bearing was maintained throughout the gyratory movement. The chief difference between this mechanism and that shown in Fig. 2 was the method adopted for raising or lowering the shaft. Supplementary packing-washers were inserted below the thrust-collar which could be changed as required.

Figs. 7 and 8 illustrate two suspension devices used by the Allis Chalmers Company, in their Style "K" crushers. The mechanism shown in Fig. 7 was fitted to machines up to and including Size 6, whilst that in Fig. 8 was applied to crushers above that size. In the former case the sleeve was made of considerable length the upper part being thicker than the lower portion inside the spider-bush. The projection due to the change in diameter formed an overhanging ledge which rested on the upper end of the bush, the contact surfaces being part spherical after the usual Gates pattern. The shaft was reduced in diameter and extended through the sleeve, being threaded to receive the clamp-nut which formed the medium for vertical adjustment and for bearing the weight.

In the larger machines the shaft was maintained at full diameter as shown in Fig. 8. No sleeve was fitted but the spider-bush was flanged over the top of the spider-boss and prepared to form a spherical seating for the loose thrust-washer which was inserted below the nut. It would appear essential that the bush should be bored slightly larger in diameter at the top than at the bottom to allow proper clearance for the shaft in the various positions limited by the extent of vertical adjustment. The sleeve in Fig. 7, furnished a measure of protection for the shaft which was lacking in the mechanism last described.

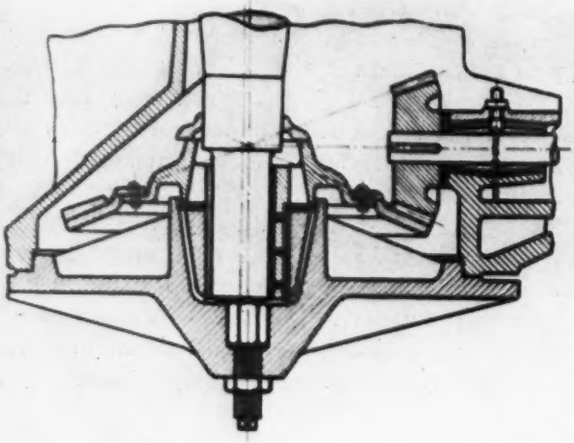


Fig. 13.

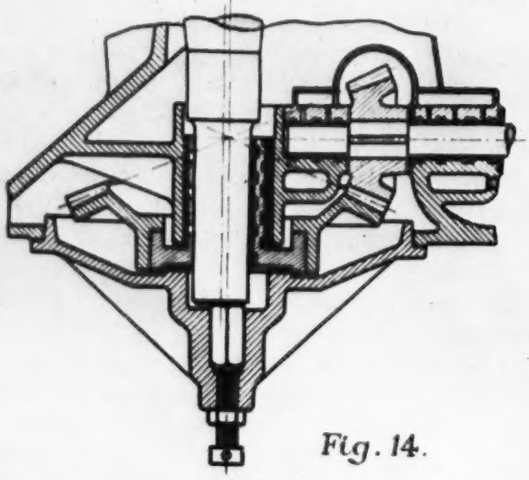


Fig. 14.

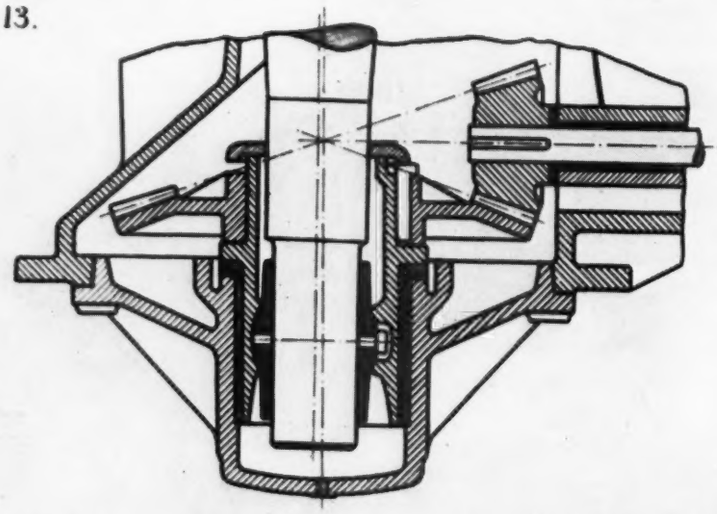


Fig. 15.

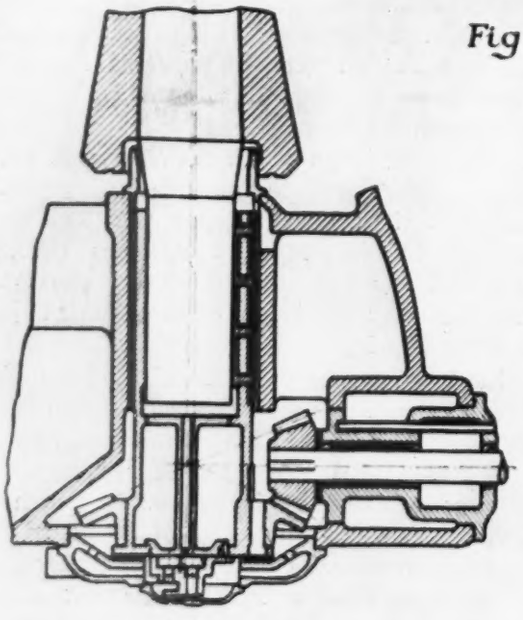


Fig. 16.

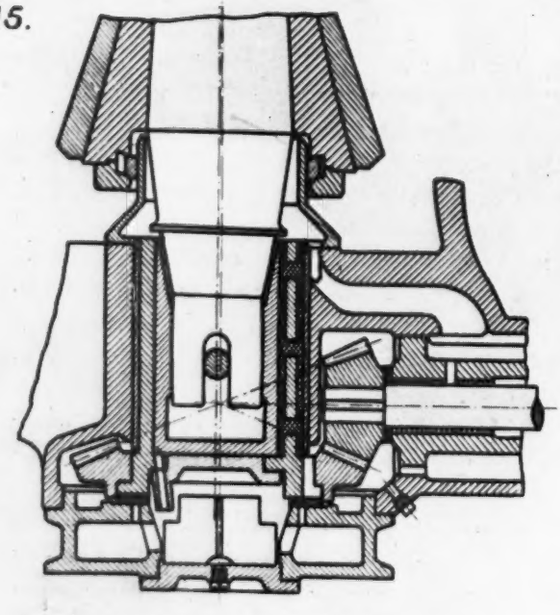


Fig. 17.

Fig. 9 shows the Austin suspension for the main shaft which included double spherical thrust-washers below the sleeve. The intermediate floating ring was made with concave bedding faces which were so formed that the curves touched close to the fulcrum point. The movement of one ring on the other was very slight and the surfaces were always in full-faced contact as compared with the limited bedding area in the McCully suspension.

The arrangement of the parts chown in Fig. 10 is, in many respects, similar to that in Fig. 8, except that the shaft was recessed instead of being screwed and that no vertical adjustment was provided except by changing the thickness of the thrust-washer or by fitting supplementary washers. This suspension was used by the Allis Chalmers Company, in some of their early sledging gyratories when the exact size of the finished product was of little moment and the vertical adjustment could be omitted. The clamping-ring was made in halves and a tight fit in the recess in the shaft.

Engineers are well aware how quickly a screw thread may be destroyed by heavy and continuous vibration acting on an imperfectly fitting nut, and it will be noted that double nuts as a locking device were soon discarded owing to their comparative inaccessibility. They were replaced bv a ring-nut with a locking key but this was not sufficiently positive to check vibration and the nuts were later cut through and drawn tight on the threads by bolts.

Fig. 11 shows the suspension system adopted by the Worthington Pump and Machinery Corporation in their larger sizes of McCully breakers. The adjusting device comprises a split nut with an independent flange-ring or collar fitting over the tapered outer surface. The collar is forced downward by a series of stud-bolts screwed into the nut and projecting through the internal flange on the ring. The encircling pressure squeezes the nut inwards until the threads are in contact with the screw on the shaft, but it is advisable that the shaft should be suspended in chain-blocks while the tightening process is being carried out so that the nut is relieved of most of the dead weight.

Fig. 12 is typical of the Traylor self-tightening suspension for gyratory crushers. The downward thrust due to the weight is made to assist in the tightening process. The nut is split and turned outside but the taper is reversed to that shown in the previous example and the shaft-sleeve is extended to form the clamping collar and bored to fit over the taper surface of the nut. The vibrations cause the conical nut to settle into the sleeve forcing the threads inwards and maintaining the grip on the shaft.

Before leaving the subject of this upper bearing it is necessary to emphasize the importance of maintaining the minimum working clearance between the outer surface of the shaft and the bore of the spider-bush. This bearing is designed to act as the fulcrum for the lever-shaft, and the center of movement is fixed at the point where the diameter of the shaft coincides with the bore of the bush.

The axis of the shaft in a gyratory crusher may be said to travel in a double conical path, the smaller travel cone being inverted above the larger which applies the crushing stroke. The apices of these two travel cones meet at the fulcrum point, and, when the correct relationship between shaft and bush is destroyed by wear, the axis of the shaft travels round the center of the spider-bush in a reflex gyratory path which lengthens the upper cone and shortens the lower, causing the fulcrum to settle down the line of the shaft. Since the crushing stroke at the top of the head is governed by the distance between the fulcrum and the head it follows that any considerable diminution in this dimension seriously affects the efficiency of the machine. Excessive clearance between shaft and bush may make the stroke too small to crush the larger pieces of stone.

The foregoing remarks and illustrations have been confined to the upper bearing for the main shaft and, although it must be admitted that this is a very material part of the machine, it is second in importance to the bearing at the lower end of the shaft which is situated at the vital center of movement for the whole mechanism.

For many years the lower bearing conformed to one standard type, which is shown in Fig. 13. The eccentric was made in cast iron and lined inside and outside for about two-thirds of the circumference with babbitt metal. The white metal was concentrated on the heavy or pressure side of the eccentric and the remaining portions of the bore and the outside of the boss were machined to agree with the contour of the bearing surfaces.

This system of construction gave renewable faces at the areas subjected to the greatest pressure and the cast iron could only come in contact with the shaft and the bore of the bottom cover in the non-pressure zones. The machined portions of the bearings integral with the casting on the neutral side of the eccentric were also used for centering the babbitting mandrels for relining the surfaces when the white metal required to be renewed.

Some accurate means for locating the correct angle for the bore in relation to the outer boss of the eccentric is very necessary in any gyratory crusher. Due to the angle of gyration the eccentricity varies from top to bottom of the bearing and, although this should be evident to any mechanic studying the operation of the crusher, the writer has known several instances where attempts have been made to run the machine with the bore of the eccentric parallel to the boss.

Occasionally, in the smaller machines, the eccen-

tric was made as a complete casting in brass or gunmetal rivetted to the gear wheel and in such cases, when the bearing was worn out, it was replaced in its entirety. In a few machines the eccentrics were made in cast steel with a circular renewable bush of babbitt metal lining the bore, the outer boss surface being of polished steel with a white metal bush in the bore of the bottom cover.

In the Gates crushers the body of the eccentric projected below the bevel wheel and revolved inside a deep oil-well bearing formed in the bottom cover, oil being supplied from the outside at stated intervals by means of a hand pump. Capillary attraction ensured the flow of the oil through the inner and outer bearings and return passages were formed in the flange of the eccentric and in the bottom cover so that the surplus was returned to the well.

The eccentric in the Austin gyratory crusher was inverted from the Gates position, as shown in Fig. 14, and was arranged to revolve inside a sleeve forming part of a false diaphragm in the bottom shell or body of the breaker. This construction relieved the bottom cover of all side-pressure due to the work of crushing and gave a strong and rigid bearing which was fitted with a renewable bushing to take-up any enlargement due to wear. Another special feature in this crusher was the additional inner bearing provided for the support of the countershaft. This design had several advantages the one drawback being that oil well lubrication was not possible and an automatic oil pump was necessary.

The main shaft in any true gyratory crusher is inclined from the vertical, its movement being restricted by the two confining bearings situated in the spider and eccentric, wear on either bearing will modify the working angle and any irregularity in tightening the spider, or the bottom cover in the old Gates type crushers, may destroy the true alignment of the two bearings. As previously explained, when the bore of the spider-bush becomes enlarged by wear the fulcrum point for the gyratory motion moves down the shaft, the journal having an independent rolling movement in the bearing. Wear in the eccentric bearing also reduces the eccentricity which again changes the angle of gyration.

It is therefore evident that, although the alignment may be perfect when the machine is new and properly put together, a number of changes may take place which will throw the bearings slightly out of line. It was usual to allow the babbitted surfaces of the eccentric bearings to bed themselves to these slight changes in angle but, in the Kennedy crusher, special provision was made, as shown in Fig. 15, so that the inner eccentric-bearing could automatically adjust itself to the working angle. The boss casting was made in halves and was clamped over a bronze bush with a spherical outer surface, the ball-and-socket joint allowing for considerable departure from the theoretical inclination.

With the advent of the short-shaft gyratories, about 1910, the eccentric was lifted to a position almost immediately below the crushing cone and the bearing sleeve was made to project through the diaphragm-plate forming the discharge chute. As the length of the shaft was reduced and the eccentric bearing brought nearer to the point of application of the crushing force one effect of change was to increase the pressure on the eccentric and reduce the load on the spider bearing.

Not only had the eccentric to work under more arduous conditions but it was so placed that a special pumping device was essential to ensure adequate lubrication.

Fig. 16 illustrates the eccentric and driving gear in the McCully short-shaft gyratory. It will be noted that the eccentric bearings are increased in area to meet the enhanced pressure and, instead of being situated immediately below the bevel wheel, the bearings are some considerable distance above the gears. Comparing Figs. 13 and 16, it may be said that the bevel gears in the two views occupy almost identical positions in relation to the other working parts of the two machines and this comparison makes the change in the position of the eccentric more evident.

A regular and copious supply of oil is absolutely necessary for the working of this type of crusher and this McCully breaker is lubricated by means of a gear-pump attached to the base-ring of the eccentric below the bevel wheel. The interior of the machine is flooded with lubricant so that the lower part of the wheel, to which the pump is secured, is continuously submerged in oil. The pump is rigidly attached to the wheel and eccentric and rotates with them, but, one of the gear-spindles projects through the pump case and carries a crank-arm engaging with a fixed pin inside the bottom cover. The circular movement of the pump round the crank-pin imparts a rotary motion to the gears forcing a stream of oil through a hole in the base of the eccentric. This oil passes upwards through the inner eccentric bearing, and, flowing over the top, finds its way back through the outer bearing to the oil-chamber in the base of the machine.

The relationship between the gear and the eccentric in this machine is not ideal, the point of application of the driving force is some distance below the bearing, no doubt this position for the wheel was chosen because the designer wished to retain in the short-shaft crusher the self-contained discharge chute which was a feature of the older gyratories, and the exigencies of space demanded that the bevel wheel should be placed below the diaphragm.

In the Traylor design for a short-shaft gyratory the bevel wheel was brought close to the eccentric, as shown in Fig. 17. In this machine the collection chute was only partly formed in the body casting, the major portion consisting of a plated receptacle attached to the base of the crusher and designed to allow sufficient space between the outer wall of the gear-enclosing chamber and the outside of the chute for free discharge of the crushed product.

Special provision was made in this breaker to compensate for any irregularities in the alignment of the main-shaft or its bearings. The lower part of the shaft was turned to a slightly spherical shape and over the shaft was fitted a sleeve with a parallel bore, the inner bearing surface being about half that outside the sleeve. The outer surface formed the journal for the inner eccentric bearing and the sleeve was prevented from revolving round the shaft by a riveted pin which passed through both walls in the casting and through a slot in the end of the shaft. This construction ensured that the inner eccentric bearing was bedding evenly over its whole area notwithstanding the fact that the shaft might be slightly out of parallel.

The lubrication system was simplified, the gear-pump being eliminated. In this type of pump the gears give out sooner or later due to wear and it frequently happens that the cessation of the oil-supply is not noticed until the bearings have been damaged. The lower cover for the gear chamber was made into a receptacle for oil and was divided into panels by radical walls in order to prevent the mass of the oil from churning round due to the surface friction from the base of the bevel wheel.

The oil was picked up by a scoop fitted into the base-ring in the bevel wheel and was forced into a circular chamfered recess at the bottom of the sleeve. Spiral oil-grooves were cut in the outer surface of the sleeve and the rotation of the inner eccentric bearing caused the oil to be drawn up the spirals to the top of the eccentric after which it gravitated through the outer bearing into the oil-chamber, a portion of the supply being deflected through the countershaft bearing.

In closing it may be well to emphasize the earlier statement that the introduction of the short-shaft design combined with adaptation of the gyratory for fine-reduction processes have tended to throw more work on to the eccentric bearings and reduce to some extent the proportion of the load borne by the spider bearing.

Overheating at the eccentric is a not uncommon fault and one firm makes provision for water-cooling to reduce this In other cases the heat generated is absorbed by an ample supply of oil which is circulated through a cooling tank. By these means it is possible to mitigate the trouble which should only be present under exceptional circumstances.

Second Government Potash Well Test Fails to Show Commercial Value

The second Government core test in New Mexico, made jointly by the Department of the Interior and the Department of Commerce under the Federal potash act, has disclosed numerous beds that contain potash, but none of them are both thick enough and rich enough to have prospective commercial value. This announcement was made today at the Geological Survey, which has just completed its examination of the core. The test was made in sec. 14, T. 20 S., R. 29 E., Eddy County, New Mexico. The site was selected by the Geological Survey, and the drilling contract was made by the Bureau of Mines. As the contract was made prior to the amendment of the potash act, the work was done under the restrictive clauses of the original act, which required reimbursement of the Government by all land owners or lessees within a radius of 1 mile from a proposed drilling site and seriously hampered the selection of desirable sites. Under the circumstances the results obtained are considered distinctly encouraging.

The test hole was drilled to a depth of about 1,100 feet, and the top of the salts was reached at about 335 feet. Indications of potash began at about 350 feet. Owing to difficulties with the drilling solutions recovery of the core in the first 50 feet of the salts was poor. This was remedied, however, by recoring this portion on an offset after the completion of the well, so that the final recovery was excellent.

A preliminary study of the core as received from the Bureau of Mines was made by the Geological Survey in the field, but the economic portions, comprising about 130 feet, were shipped into Washington for study in the Geological Survey laboratories. All this material was subjected to mineralogic examination and qualitative tests for both potash and boron. Only four of the samples tested for boron gave indications of containing as much as 0.1 per cent of B_2O_3, and none of these were quantitatively analyzed. Thirty-eight samples were analyzed quantitatively for potash, and the results of most of the analyses are shown graphically in the accompanying diagram. The beds represented range in thickness from 9 inches to 7 feet 7 inches and in potash content from 1.9 to 13.94 per cent. The thickest bed, which lies between depths of 628 feet 3 inches and 635 feet 10 inches contains somewhat less than 4 per cent of K_2O, whereas the richest bed, which lies between depths of 809 feet 7 inches and 812 feet and contains about 14 per cent of K_2O, is only 2 feet 5 inches thick.

In the first coring 20 inches of salts containing 11.63 per cent of K_2O was recovered. In the second coring 21 inches containing 6.85 per cent and 14 inches containing 5.21 per cent was recovered.

PIT AND QUARRY FOREIGN DIGEST

Influence of Calcium Chloride

Calcium chloride vigorously accelerates the setting of Portland, iron Portland and blast furnace cement, but the hardening period is not appreciably hastened, as figure 1 shows. But $CaCl_2$ does not affect all cements in similar fashion.

Figures 2 and 3 show examples of the effect with different cements, N being Portland cement and B. I iron Portland. They show that at low temperatures (about 40 degrees F.) the accelerating effect of $CaCl_2$ also takes place. Figure 5 shows the effect on aluminous cement (M) in which case the strength is decreased instead of raised. The results show that the checking of the setting at low temperatures may be avoided by the use of calcium chloride, but care must be used in selecting the cement for use with this salt. The amount of addition should be increased with the lowering of the temperature.

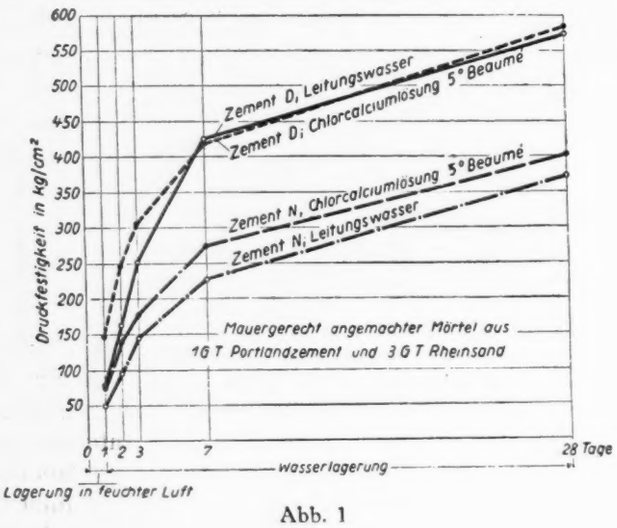


Abb. 1

Figure 1

Calcium chloride affects other characteristics of cement mortars beside that of crushing strength. For certain important engineering work such as stacks and paving streets the influence of the addition expansion and contraction is important. Mortars were made up with 1:3 cement—sand mixtures and 1:6 mixtures with and without calcium chloride. The water used consisted of 5 and 10 degrees Bé calcium chloride solution as well as pure water. The mortars were cured by 1 day moist air, 6 days under water and then 119 days in dry air. The measurements were begun at the end of 7 days. Figure 8 contains the results of these experiments. The shrinking and swelling caused by calcium chloride addition is distinctly exaggerated in this diagram. It is again demonstrated that before use of $CaCl_2$ in cement mortars all the conditions must be carefully examined. O. Graf (Zement, Aug. 25, 1927. pp. 776-777).

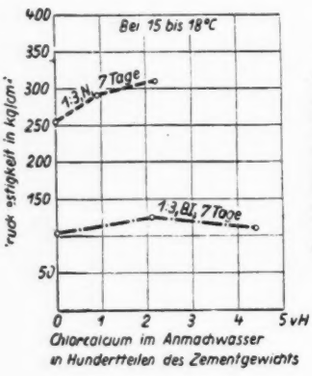


Abb. 2

Figure 3

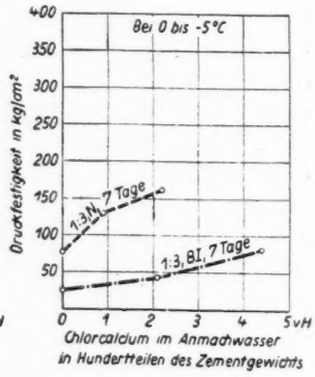


Abb. 3

Figure 2

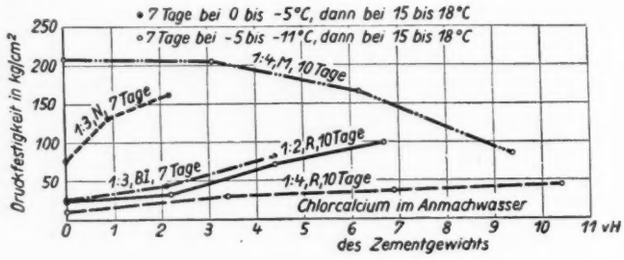

• 7 Tage bei 0 bis -5°C, dann bei 15 bis 18°C
◦ 7 Tage bei -5 bis -11°C, dann bei 15 bis 18°C
1:4,M, 10 Tage
1:3,N, 7 Tage
1:2,R,10 Tage
1:3,BI, 7 Tage
1:4,R,10 Tage
Druckfestigkeit in kg/cm²
Chlorcalcium im Anmachwasser
des Zementgewichts

Abb. 5

Figure 5

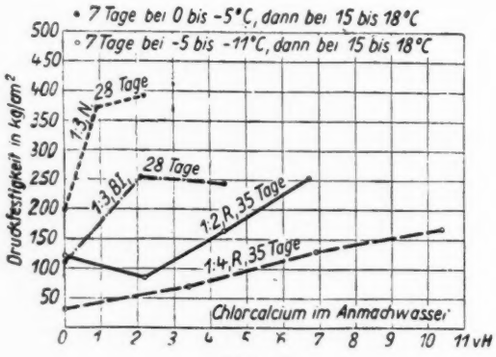

• 7 Tage bei 0 bis -5°C, dann bei 15 bis 18°C
◦ 7 Tage bei -5 bis -11°C, dann bei 15 bis 18°C
1:3,N, 28 Tage
1:3,BI, 28 Tage
1:2,R,35 Tage
1:4,R,35 Tage
Druckfestigkeit in kg/cm²
Chlorcalcium im Anmachwasser

Abb. 6

Figure 6

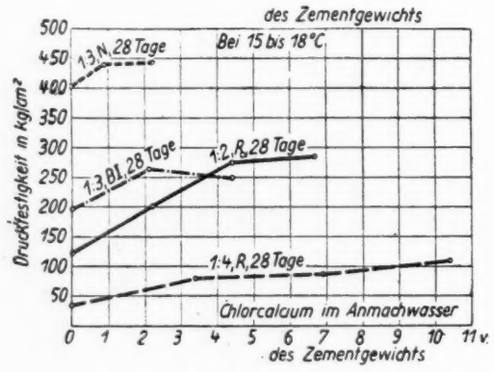


Abb. 7

Figure 7

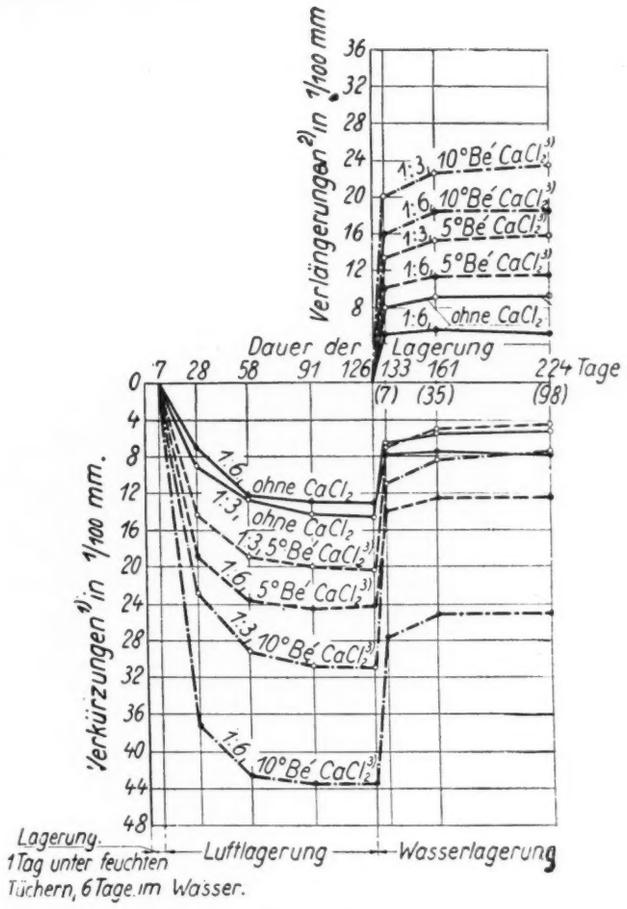


Figure 8

Hydrated Alumina of Bauxite

Alumina exists in bauxite either as its hydrate or in the form of a hydrated aluminium silicate. Crystals have been found and observed in bauxite of hydrargillite, kaolinite and kalloysite. Certain bauxites have a composition mainly of the mono hydrate ($Al_2O_3 \cdot H_2O$) differing from the composition of hydrargillite, ($Al_2O_3 \cdot 3H_2O$). The name Boehmite is suggested for aluminium hydroxide with one molecule of water of crystallization, after the discoverer of this mineral. de Lapparent (Le Ciment, August, 1927. pp. 293-4).

Rapid Hardening Cements

Artificial cements of high initial strength lose their properties (1) if they are used several months after their manufacture, or (2) if the maximum precautions are not taken against contact with the moisture in the air in yards and warehouses. These cements are defined as those which exhibit a hardness in 2 days at least as great as that obtained in 28 days from ordinary Portland. They should not contain more than 10 per cent of aluminum or more than 1 per cent free or combined sulphur, nor more than 2 per cent of magnesium. Not more than 10 per cent should remain on the 4900 mesh (per cm.) sieve nor more than 5 per cent on the 900 mesh. The cement, when immersed in potable water should not begin to set in less than one-half hour. The period of setting must take not less than two hours nor more than 7. The tensile strength per square cm. must not be less than 22 kilos after hardening for two days, and the compression strength must be at least 150 kilo at the end of the same interval. Anon. (Union Technique du Bâtiment et des Travaux Publics.)

Grinding Phenomena

(1) The resulting product depends upon the characteristics of the rock ground; (2) all grinding implies simultaneously a limiting action of the grain size of the product. The following laws have been proposed:

(a) If a product composed of grains of rock structurally homogeneous is ground, there results a product in which the relation between the percentage of weight of grains of diverse size and those of the same size follow a well defined mathematical law. This is not true for a rock of heterogeneous structure. (b) In the crushing of homogeneous rock the grinding takes place more by shearing across the grain than by wearing away of the surface except in the case of a ball mill, where the relation between the diameter of the grains to be ground and that of the balls exceeds a critical limit. (c) In the last instance the grains are worn down and not broken. A. M. Gandin (Revue de Metallurgie).

Effect of Mica on Mortar Strength

Mortars were prepared (1) with standard laboratory aggregate, (2) with the same aggregate plus 10 per cent of mica powder and (3) with addition of 10 per cent of mica in fine plates. The results obtained were:

	Standard Mortar	10% mica Powder	10% mica Plates
Strength in 7 days	.192 kg.	206 kg.	34 kg.
Strength in 28 days	.281 kg.	193 kg.	20 kg.

It appears, therefore, that mica either in powder or plate form destroys the efficacy of the mortar. Anon. (Union technique du Bâtiment et des Travaux Publics).

Water and Mortar Strength

A mortar or concrete is not only a mixture of cement and aggregate, but a mixture of cement, aggregate and water. It should be noted, however, that the greatest strength does not correspond with the minimum of water so far as aluminous and Portland are concerned. On the other hand, use of a large excess of water causes a loss of ⅔ the strength of aluminous cement and for Portland and slag cements of ⅚ of the maximum strength. Experiments on rapid hardening cements show that 50 per cent of the weight of water gives maximum strength while equal parts of water and cement show less than 10 per cent of this strength. Anon. (Union Technique du Bâtiment et des travaux

DISTRIBUTION OF CEMENT

Portland cement shipped from mills into States, in June and July, 1926 and 1927, in barrels*

Shipped to	June 1926	June 1927	July 1926	July 1927
Alabama	215,892	155,252	184,577	207,386
Alaska	1,130	1,823	1,386	2,029
Arizona	46,262	45,172	35,817	38,125
Arkansas	66,835	77,555	73,292	72,502
California	1,187,724	1,153,990	1,173,099	1,077,710
Colorado	124,451	95,029	117,990	113,490
Connecticut	206,301	255,970	218,375	258,232
Delaware	45,642	32,807	38,228	18,765
District of Columbia	86,218	87,224	94,852	105,400
Florida	297,204	199,406	284,281	166,647
Georgia	174,488	196,027	213,432	179,713
Hawaii	14,360	31,227	12,761	34,500
Idaho	54,424	29,085	47,991	28,166
Illinois	1,854,806	1,921,502	†1,857,871	1,962,942
Indiana	673,087	739,188	†698,427	771,651
Iowa	329,422	553,469	353,529	486,109
Kansas	247,335	243,653	230,022	263,430
Kentucky	181,121	201,477	†200,154	239,555
Louisiana	106,338	119,191	112,958	147,449
Maine	66,264	67,820	67,475	82,034
Maryland	244,763	245,061	221,600	272,142
Massachusetts	338,079	320,541	331,320	290,232
Michigan	1,439,270	1,504,877	†1,504,056	1,360,516
Minnesota	526,695	485,312	475,846	419,976
Mississippi	73,345	76,227	89,752	102,252
Missouri	631,184	438,193	653,615	481,281
Montana	23,114	33,243	38,749	39,521
Nebraska	187,780	145,564	172,489	150,181
Nevada	9,895	12,853	7,878	10,139
New Hampshire	48,285	47,672	55,233	50,796
New Jersey	773,450	944,454	793,625	844,190
New Mexico	16,222	21,991	14,736	18,160
New York	2,475,868	†2,869,955	2,336,788	2,467,699
North Carolina	420,248	325,413	396,618	321,348
North Dakota	75,470	74,012	62,581	71,813
Ohio	1,319,226	1,309,273	†1,272,308	1,166,296
Oklahoma	219,946	266,615	205,345	287,638
Oregon	150,962	172,173	151,296	187,401
Pennsylvania	1,697,387	1,719,593	1,618,569	1,573,559
Porto Rico	0	1,750	0	3,000
Rhode Island	80,912	68,486	65,525	69,599
South Carolina	47,279	64,616	53,506	63,414
South Dakota	53,091	54,405	46,987	50,896
Tennessee	206,917	219,588	213,058	269,184
Texas	447,231	419,994	481,008	436,475
Utah	66,883	40,344	50,306	41,478
Vermont	32,291	42,594	38,607	45,365
Virginia	211,665	204,817	180,085	195,133
Washington	260,756	295,426	239,146	299,400
West Virginia	208,797	170,166	†214,948	194,693
Wisconsin	691,934	869,960	704,770	858,526
Wyoming	20,331	25,173	19,973	20,374
Unspecified	80,565	†16,202	†599	29,843
	19,059,145	†19,713,410	†18,727,439	18,948,355
Foreign Countries	74,855	47,590	84,561	35,645
Total shipped from cement plants	19,134,000	†19,761,000	18,812,000	18,984,000

*Includes estimated distribution of shipments from three plants in June and July, 1927; from four plants in June, 1926; and from five plants in July, 1926.
†Revised.

Production, shipments, and stocks of finished Portland cement, by districts, in August, 1926 and 1927, and stocks in July, 1927

Commercial District	August Production 1926	August Production 1927	August Shipments 1926	August Shipments 1927	Stocks at end of August 1926	Stocks at end of August 1927	Stocks at end of July 1927*
Eastern Pa., N. J. & Md.	3,901,000	4,245,000	4,212,000	4,484,000	3,375,000	4,007,000	4,247,000
New York	936,000	1,348,000	1,086,000	1,514,000	842,000	1,365,000	1,531,000
Ohio, Western Pa., & W. Va.	*1,824,000	1,967,000	*1,897,000	2,489,000	2,036,000	2,284,000	2,806,000
Michigan	1,508,000	1,661,000	1,806,000	2,146,000	1,261,000	1,257,000	1,743,000
Wis., Ill., Ind., & Ky.	*2,414,000	2,492,000	*2,889,000	3,119,000	1,925,000	1,231,000	1,857,000
Va., Tenn., Ala., Ga. & La.†	1,366,000	1,522,000	1,427,000	1,628,000	1,089,000	1,145,000	1,251,000
Eastern Mo., Ia., Minn. & S. D.	1,561,000	1,585,000	1,720,000	2,267,000	2,078,000	1,737,000	2,419,000
Western Mo., Neb., Kan. & Okla.	1,162,000	943,000	1,192,000	1,149,000	1,331,000	1,466,000	1,672,000
Texas	440,000	496,000	494,000	561,000	418,000	251,000	316,000
Col., Mont., Utah	309,000	216,000	297,000	293,000	425,000	454,000	531,000
California	1,248,000	1,399,000	1,258,000	1,306,000	504,000	717,000	624,000
Oregon and Washington	326,000	431,000	305,000	455,000	434,000	376,000	400,000
	16,995,000	18,305,000	18,583,000	21,411,000	15,718,000	16,290,000	19,397,000

*Revised. †Began producing June, 1927, and shipping July, 1927.

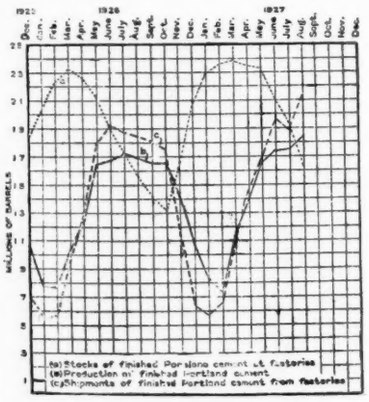
Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico, in July, 1927*

	Barrels	Value
Alaska	4,726	$ 14,473
Hawaii	42,224	109,851
Porto Rico	1,350	3,394
	48,300	$127,718

*Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

AUGUST CEMENT STATISTICS

The recurrent summer rise carried the curves of production and shipments of Portland cement to new peaks in August, according to the Bureau of Mines, Department of Commerce. Production shows an increase of nearly 8 per cent; shipments an increase of over 15 per cent over the corresponding period in 1926. Portland cement stocks are still declining


1925
1926
1927
MILLIONS OF BARRELS
(a) Stocks of finished Portland cement at factories
(b) Production of finished Portland cement
(c) Shipments of finished Portland cement from factories

but are nearly 4 per cent in excess of the stocks at the end of August, 1926.

The output of another new plant, located in Pennsylvania, is included in these statistics, which are prepared by the Division of Mineral Statistics of the Bureau of Mines and are compiled from reports for August, 1927, received direct from all manufacturing plants except two, for which estimates are necessary on account of lack of returns.

Relation of production to capacity: Conservative estimates recently made and subject to revision, based upon reported capacity of plants at the close of 1925, the 1926 production record, and upon available data as to capacity of new plants, place the total annual capacity of the 149 plants covered in this report at about 213,700,000 barrels, an increase of over 10 per cent as compared with capacity at the end of 1925 and of nearly 5 per cent since the beginning of 1927. For the period January to August, 1927, inclusive, the available capacity for commercial production has amounted to nearly 121,000,000 barrels. Thus, although the ouput during August represents approximately full capacity of the plants for that month, the cumulative production for August to January, 1927, is but 91.5 per cent of the available capacity. The approximate relation of production to available capacity during preceding years and the months of 1927 has been as follows: 1925, 83.5 per cent; 1926, 80.5; January, 1927, 47.6; February, 47.0; March, 65.5;

April 82.8; May, 92.8; June, 98.6; July, 96.3. With the usual late fall and winter decline in production and the added capacity of plants to be completed during the remainder of the year the ratio of annual production to capacity is expected to decrease to about that of 1926.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20 cents each. State number of patent and name of inventor when ordering.

1,639,050. Mining-machine. Edmund C. Morgan, New York, N. Y.

16,639,346. Loading apparatus. William K. Liggett, Columbus, Ohio, assignor to Jeffrey Mfg. Co., same place.

1,639,421. Steam shovel. Henry J. Barnhart, Marion, Ohio, assignor to Osgood Co., same place.

1,639,678. Multiple deck screen. Herbert S. Woodward, Carbondale, Pa.

1,639,741. Disloding mechanism. Nil D. Levin, Columbus, Ohio, asignor to Jeffrey Mfg. Co., same place.

1,639,752. Power shovel. Leslie A. Russell, Milwaukee, Wis., asignor to Koehring Co., same place.

1,639,915. Apparatus for washing coal and ore. George W. Wilmot, Hazelton, Pa., assignor to Wilmot Engineering Co., same place.

1,640,055. Power shovel. William W. Sloane, Chicago, Ill., assignor to Goodman Mfg. Co., same place.

1,640,124. Jib-crane excavator. Samuel King, Carlingford, New South Wales, Australia.

1,640,174. Flexible seal for mixers. Frederic E. Bager, South Milwaukee, Wis., assignor to T. L. Smith Co., Milwaukee, Wis.

1,640,221. Loading-skip for concrete mixers. Samuel Shafer, jr., Milwaukee, Wis., assignor to Chain Belt Co., same place.

1,640,602. Hydration of lime. Hippolyt Dittlinger, New Braunfels, Tex., Dittlinger Crow Process Co., same place.

1,641,430. Mining apparatus. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co., same place.

1,641,726. Crusher and method of constructing the same. John S. Bond, Milwaukee, Wis., assignor to Allis-Chalmers Mfg. Co., same place.

1,641,776. Crusher. Ray C. Newhouse, Wauwatosa, Wis., assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Production, shipments, and stocks of finished Portland cement, by months, in 1926 and 1927

(Figures represent thousands of barrels)

Month	Production 1926	Production 1927	Shipments 1926	Shipments 1927	Stocks at end of month 1926	Stocks at end of month 1927
January	7,887,000	8,258,000	5,674,000	5,968,000	20,582,000	22,914,000
February	7,731,000	7,377,000	5,820,000	6,731,000	22,385,000	23,560,000
March	10,390,000	11,452,000	9,539,000	11,083,000	23,236,000	23,922,000
1st quarter	26,008,000	27,087,000	21,033,000	23,782,000	.....	.....
April	12,440,000	14,048,000	12,965,000	14,350,000	22,710,000	23,654,000
May	16,510,000	*16,701,000	17,973,000	*16,865,000	21,255,000	*23,503,000
June	16,866,000	*17,224,000	19,134,000	*19,761,000	19,000,000	*20,972,000
1st quarter	26,008,000	27,087,000	21,033,000	23,782,000	.....	.....
July	17,134,000	17,398,000	18,812,000	18,984,000	17,301,000	*19,397,000
August	16,995,000	18,305,000	18,583,000	21,411,000	15,718,000	16,290,000
September	16,571,000	.....	18,087,000	.....	14,188,000	.....
2nd quarter	45,816,000	*47,973,000	50,072,000	*50,976,000	.....	.....
October	16,596,000	.....	17,486,000	.....	13,334,000	.....
November	14,193,000	.....	11,276,000	.....	16,243,000	.....
December	10,744,000	.....	6,432,000	.....	20,616,000	.....
4th quarter	41,533,000	.....	35,194,000	.....	.....	.....
	164,057,000	.....	161,781,000	.....	.....	.....

*Revised.

EXPORTS AND IMPORTS[a]

Exports of hydraulic cement by countries in July, 1927

Exported to	Barrels	Value
Canada	2,325	$ 10,045
Central America	9,202	9,888
Cuba	14,900	37,784
Other West Indies and Bermuda	3,902	9,112
Mexico	5,523	17,809
South America	29,451	101,940
Others	7,034	43,159
	72,337	$229,737

Imports of hydraulic cement by countries, and by districts, in July, 1927

Imported from	District into which imported	Barrels	Value
Belgium	Florida	25,959	$ 36,904
	Massachusetts	3,700	4,296
	New Orleans	6,214	17,402
	New York	3,000	3,256
	Philadelphia	32,477	46,092
	Porto Rico	1,000	2,107
	San Francisco	3,000	5,756
	Washington	3,000	3,782
	Total	78,350	$119,595
Canada	Saint Lawrence	3,217	6,695
	Vermont	186	312
	Total	3,403	7,007
Denmark	New York	1,875	5,978
	Porto Rico	18,096	26,043
	Total	19,971	32,021
France	New York	5	24
Norway	Los Angeles	500	572
	Philadelphia	8,975	12,203
	South Carolina	60,659	72,634
	Total	70,134	85,409
Soviet Russia in Europe	New York	3	30
United Kingdom	New York	1,486	3,069
	Oregon	995	1,602
	Philadelphia	688	908
	Total	3,169	5,579
	Grand total	175,035	$249,665

Exports and imports of hydraulic cement, by months, in 1926 and 1927

Month	Exports 1926 Barrels	Exports 1926 Value	Exports 1927 Barrels	Exports 1927 Value	Imports 1926 Barrels	Imports 1926 Value	Imports 1927 Barrels	Imports 1927 Value
January	72,939	$ 216,431	75,346	$254,072	360,580	$ 576,600	193,175	$269,661
February	73,975	220,706	71,404	233,985	308,161	527,948	130,421	200,680
March	69,080	205,647	67,956	240,165	493,241	812,968	181,145	261,519
April	96,296	284,772	72,383	243,832	257,302	398,114	191,868	313,262
May	78,601	224,365	59,332	205,574	223,130	337,031	178,929	263,618
June	80,684	248,814	69,205	237,281	323,656	495,744	129,111	201,682
July	130,822	370,220	72,337	229,737	250,862	395,981	175,035	249,665
August	64,946	216,489	.....	.....	350,638	560,532	.....	.....
September	70,920	239,174	.....	.....	194,129	308,224	.....	.....
October	69,389	225,874	.....	.....	263,403	386,335	.....	.....
November	76,698	238,103	.....	.....	55,225	82,949	.....	.....
December	89,976	305,238	.....	.....	152,059	242,974	.....	.....
	974,326	$2,995,833	.....	.....	3,232,386	$5,125,400	.....	.....

INTIMATE NEWS OF MEN AND PLANTS

West Virginia Company First With Diesel Side Dredge

What is said to be the first application of Diesel power to a side ladder dredge was recently installed on the "Mountaineer," a new dredge operated on the Elk River in West Virginia by the West Virginia Sand and Gravel Company. The Elk river has always been an important source of clean, sharp sand for use in construction work and the dredges used in the past on this operation have been of the side ladder type, steam driven.

The side ladder dredge has been found very satisfactory for working in this narrow river which has sharp bends as it can work in close to the bank and can also be easily manipulated around large boulders and other obstructions without slowing down the work.

Another important advantage is due to the fact that the side ladder dredge does not handle as much water in proportion to the amount of material delivered as does a suction dredge. This results in lower fuel costs.

When the West Virginia Sand & Gravel Company considered the building of a new dredge they decided to get entirely away from precedent and so they laid out a dredge with a steel hull to be equipped with Diesel engine power. That the foresight of the company was based on good business judgment is shown by the fact that the new dredge has reduced the cost of digging sand to a point where L. F. Southerland, Superintendent, states that they are now able to go after business that they were unable to obtain before owing to the higher production cost of the steam driven side ladder dredge.

The operating crew of the Diesel equipped dredge consists of only one man and a helper who also acts as a deck hand on the shafter boat. The fact that there is no coal to handle or tow is an important factor in reducing the cost of operation.

The new dredge "Mountaineer" has a steel hull which was supplied by the Midland Barge Company with a length of 105 feet, a width of 24 feet, a depth of 5 feet 6 inches and the draft is 35 inches. The digging ladder is 75 feet long and will dig in 45 feet of water. This ladder is equipped with manganese steel buckets 28 by 14 by 18 inches. There are thirty-eight in the set and at normal speed of the engine sixteen of the buckets dump per minute. The buckets are side connected with double links 30 inches on center and the ladder elevates between 2¼ and 2½ tons of material per minute and discharges about 1¾ tons of sand per minute.

When the dredge was designed, Fairbanks, Morse and Company was consulted regarding the layout of the Diesel engine drive. Since this was the first time that a Diesel engine had been applied to a side ladder dredge the arrangement of the equipment was given considerable study. The recommendation was made that an 80 hp. stationary type Diesel engine be installed, which would drive the digging buckets by belt drive from a reversing clutch pulley on the engine. An extension shaft and bearings were then provided for driving a jackshaft which would in turn drive a 45 kilowatt direct current generator and a 4 inch centrifugal pump. The recommendations were accepted and the engine room equipment of the "Mountaineer" was installed in this way. The direct current generator supplies current for the two hoists, one hoist being used to handle the digging ladder and one spud and the other hoist to handle the other spud lines and maneuvering lines.

The construction of the dredge with the exception of the steel hull was handled by the employees of the West Virginia Sand and Gravel Company and the dredge went into service on April 30th of this year.

Cement Plant Being Planned

Construction will start at once on a $750,000 cement producing project in Cajon Pass two miles north of Devore, California, along the line of the Santa Fe and the Union Pacific Railways by the American Portland Cement Company. The plant will be built to produce 2,000 barrels per day at the start and this will later be increased to 4 000 barrels per day. The entire output of the quarry and the cement plant will be consumed by the American Portland Cement Company in manufacturing a new type of building brick on patents formerly owned by W. H. Houghton. In the city of San Bernardino will be constructed a plant to manufacture the building brick which will be used in the construction of fireproof buildings.

Big Plant Changes Hands

For a consideration of nearly half a million dollars, as reported by Carter, MacDonald & Miller, Inc., representing the buyer, J. T. Heffernan, of Seattle, Washington, has purchased from the State Gravel Company a gravel pit 350 acres in extent, located near Stellacoom. This property is said to be the largest body of commercial gravel in the State of Washington. It is estimated to contain about 80,000,000 yards. The bank of gravel is 250 feet in depth. The machinery at the pit was valued at $130,000.

Soapstone Deposit Found By Accident

A blast to remove a portion of ledge in repairing the Acton road in East Lebanon, Maine, uncovered what promises to be a large deposit of soapstone, and the discovery may lead to the establishment of a new soapstone operation within a short time, as soapstone is scarce at present and many firms using it are eagerly seeking a supply. J. Porter Jones was in charge of the road blasting, and when the first charge revealed a curious sort of stone which none of the men assisting could name, a specimen was taken to Fred J. Meekins of Boston, who pronounced it to be soapstone of the very best quality. His firm, he said, was in urgent need of such stone and had searched New England from one end to the other without finding any.

Strange to say, some of this stone has been exposed to view in a place 100 rods long and 20 rods wide in places and nobody has recognized it.

Mr. Meekins said that his firm alone had been compelled to reject a pile of orders a foot high because of the inability to obtain soapstone to fill them. He investigated the deposit, which is principally on the farm of Richard E. Hersom, but extends some distance on the farms of Linwood J. Wentworth and Charles E. Cross and is of immense proportions. Hitherto it had been supposed that the soapstone deposits of New England were exhausted.

Propose New Nitrate Plant

A. A. Snell and associates of Marfa, Texas, have incorporated for $500,000 and plan to develop 4000 acres in Presidio County, Texas, for a sodium nitrate and potash plant to have a capacity of from 300 to 500 tons per day. They plan to operate motor trucks to the property until the railroad has been extended to reach it.

Portland Cement Association Joins Standards Committee

The Portland Cement Association has become a member of the American Engineering Standards Committee, with direct representation on the Main and Executive Committees. F. W. Kelley, President of the North American Cement Association represents the Association as a member of the A. E. S. C. Executive Committee.

J. M. Boyd Advanced

J. M. Boyd has resigned his position with the Darlington Fireproofing Company of Toronto, Ohio, to accept the superintendency of the plant of the United Clay Products Company in Washington, D. C. The United Clay Products Company is a new concern representing a consolidation of six plants in West Virginia, Washington and Pennsylvania. A. T. Chewning, formerly of St. Mary's, Pa., is president of the new concern.

New Virginia Stone Plant

The Trego Stone Corporation has constructed a new and very modern crushed stone plant at Emporia, Virginia. The chief product of this plant will be railroad ballast and the quarry was selected because it yielded granite exceptionally suitable for this purpose. The quarry has an overburden averaging about 12 feet of clay and fine sand which is removed with an Erie shovel loading into 4¼ yard Western dump cars drawn by a Vulcan locomotive.

The present quarry face is about 78 feet high and the stone is prepared for blasting by four air drills. The broken rock is loaded by a Marion No. 37 electric shovel into a Koppel car that runs on an incline to the surface. This incline has a 19 per cent grade and the capacity of the car is 11 tons. Power is supplied by an Allis-Chalmers electric hoist and about two minutes are required for the car to make a round trip. At the top of the incline the car is dumped by a compressed air dumper into a 40x60 inch Superior jaw crusher and from the crusher is carried on a 114 feet centers Stephens Adamson belt conveyor to a 20 inch McCully secondary crusher. Another belt conveyor takes the product from the secondary crusher to a scalping screen and the oversize from this screen flows to two reduction crushers. Material from the scalping screen and the reduction crushers is elevated by a bucket conveyor to the sizing screens. The storage bins are of wood and steel on concrete bases and have a total storage capacity of 12 standard 50 ton gondola cars.

Open Deepest Gypsum Mine

The United States Gypsum Company has opened its number 6 mine at Plasterco, Virginia said to be the deepest gypsum mine in the world. The shaft descends 560 feet.

Adds New Storage Equipment

The W. R. Spalding Company, of Visalia, California, have added to their already extensive material yard sand and stone bunkers with a capacity of 750 tons, said to be the largest bunker equipment between Fresno and Bakersfield. The bunkers are located near the Santa Fe tracks and are served by a special spur track. It is the intention of the Spalding Company to keep the bunkers loaded at all times with four sizes of crushed stone and two grades of sand.

Rich Potash Deposits Found in Texas

From Big Spring, Texas, comes the report that the Landreth Production Company, drilling on the Houston ranch on the northwest quarter of section 12, block 35, township 2 south, 25 miles southwest of Big Spring, has strck the richest potash yet fond in any wells in this territory. Showings were fonud at 1,430 feet and have increased in percentage of potash to 1,866 feet, where they are now drilling. Samples are being sent to the state chemist for analysis.

Sand Plant Destroyed

A sand plant operated by the Asphalt Block Pavement Company of Cleveland and located near Point Mills, Michigan, was destroyed by fire recently. The cause of the fire is not known, several buildings being completely lost when the fire spread due to lack of an adequate water supply. The loss is partly covered by insurance, according to August Koppleman, superintendent of the burned plant.

"Cal" Building Burns

The North American Cement Corporations "Cal" building located at Berkeley, California, burned down recently at a loss of $60,000.

Developing Gypsum Beds in New Mexico

According to late reports plans are going forward for an extensive commercialization of the great beds of gypsum lying west of Alamogordo, New Mexico. Local capital is said to have secured leases on 63,000 acres in this district and to be planning the erection of a large plant.

Pioneer Sand and Gravel Uses Bathtub Trucks

The Pioneer Sand and Gravel Company of Seattle operate a number of trucks for hauling ready mixed concrete which are equipped wtih a body similar to a bathtub. The body is elevated to a very high dumping angle in order that the material may be cleaned out thoroughly. The hoist is of special design and very fast in operation.

France Purchase Quarry

The France Stone Company has purchased the Consumers Lime Quarry of Tiffin, Ohio.

Safety Trophy Awarded To Berkely Quarry

One of the principal features of the Second Annual State Safety Day held in Morgantown, West Virginia, September 17th, was the official presentations of the Sentinels of Safety Trophy awarded by The Explosives Engineer magazine to the winning mines and quarries in the National Safety Competition conducted by the United States Bureau of Mines.

The bituminous coal mine and the quarry which led their respective groups in this competition for 1926 are both situated in West Virginia. In addition to this fact the state can mine of the United States Coal & Coke Company, Gary, West Virginia, is being awarded the trophy for the second time; and the Berkeley Quarry at Martinsburg, the 1926 winner, is operated by the North American Cement Corporation, who also won the trophy the preceding year at their quarry in Hagerstown, Maryland.

Mr. W. W. Adams, Supervising Statistician, Mineral Resources Division of the United States Bureau of Mines, presented the trophies to the two winning companies. He also personally visited the mine and quarry and give to each employee of the winning plants a certificate of honor signed by the Director of the United States Bureau of Mines.

In a personal letter of congratulation to each of the winning mines and quarries, Herbert Hoover, Secretary of Commerce wrote as follows: "The excellent safety record established by your company at one of its plants as shown by the results of the National Safety Competition is a matter for congratulation to your company and of encouragement to all persons interested in safety in the mineral industry. It is such work that affords the best hope that the United States may lead the world in mine safety as it is already leading in mineral production."

New Incorporations

French-Anderson-Corriere Crushed Rock Corp., Murphy Canon, Mission Valley, Calif. $40,000. S. W. French, A. Anderson, J. A. Corriere, O. T. Dennhart, Supt.

Dunes Sand Co., Gary, Ind. $25,000. C. E. O'Malley, H. W. Lackey, N. M. Fredrickson.

American Portland Cement Co., W. P. Story Bldg., Los Angeles, Calif. $2,500,000. Briant S. Young, Pres.; Max O. Miller, V. P.; U. J. Rogers, Sec.-Treas. Will build cement plant at San Bernardino, Calif.

Moreau Gravel Co., Jefferson City, Mo. J. W. Walsh, Mrs. Mary A. Gersting, Mrs. Bertha Happy.

Cuban Rock Asphalt Co., Inc., New Orleans, La., $1,000,000. E. R. Mendez, Pres., 4036 St. Charles St.; Edwin O. Cook, Sec., 1803 Carrollton St.

Old Dominion Soapstone Co., Continental Bldg., Baltimore, Mr. $10,000. E. Lawrence Dinning, Jr., V. P. & Gen. Mgr.; Ernest L. Dinning, Pres. & Treas. Will develop soapstone deposits near Clifton Station, Va.

Smith Supply Co., High Point, N. C. W. L. Smith, Jr., Hillcrest St., High Point; A. E. Tapfin, 116 N. Main St., High Point; T. E. Jennings, Thomasville. Crushed Stone. $50,000.

Weymouth Washed Sand & Gravel Co., Weymouth, Mass. 280 shares, n.p.v. Thomas H. Hannaford, Pres.; Anthony L. Cassese, Treas.; William A. Hannaford.

American Petrifite Co., Seattle, Wash. $99,990. Sand, gravel, stone products. Ernest Walters, W. A. Wilson.

Bowling Green Rock Asphalt Co., Philadelphia, Pa. $750,000. J. Vernon Primm.

Reservation Sand & Gravel Corp., Irving, N. Y. $250,000. F. J. Knorr, Albany, N. Y.

Commonwealth Portland Cement Corp. 27,000 shares, n.p.v. (New York-Delaware Registration Co., Wilmington, Dela.)

B. G. Hoadley Quarries, Inc., Bloomington, Ind. $200,000. Bird G. Hoadley, Katharyn K. Hoadley, John A. Hoadley. Stone.

W. L. Sampson & Co., Dover-Foxcroft, Maine. $20,000. Quarry stone. Wm. L. Sampson, Pres.; Paul E. Garrison, Treas.; Edward J. Mayo.

Clarence Sand & Gravel Co., Inc., Clarence, Erie Co., N. Y. $500,000. Incorporator, Millard P. Ryley, 40 Jewett Parkway, Buffalo, N. Y.

Smoot Sand & Gravel Corp., 300 shares. (Corp. Trust Co. of Amer., Wilmington, Dela.)

Millville Gravel & Sand Co., Millville, N. J. $50,000. J. Roy Oliver.

Bathurst Feldspar Mines, Ltd., Toronto, Ont., Can. 80,000 shares.

Better Use of Wire Saws in Slate Quarrying

The initial step in quarrying slate is to separate from the solid ledge, masses of a size that may be conveniently removed from the quarry. This first step entails a greater waste of material than any subsequent process, and, therefore, invites the most earnest effort toward waste reduction. Attention has consequently been directed toward possible improvements in methods of making primary cuts in the quarry floor. A study of European practice with the wire saw, together with theoretical consideration of its advantages, convinced the writer that it possessed sufficient merit to justify its use as a primary slate cutter in American quarries.

In collaboration with W. S. Hays, Secretary of the National Slate Association, it was arranged that five Pennsylvania slate companies would co-operate with the Nonmetallic Minerals Experiment Station of the Bureau of Mines in purchasing the equipment.

The wire saw consists of a three-strand steel cable, slightly more than 3/16 inch in diameter, running as an endless belt. The wires used in the tests recently made were between 600 and 900 feet long. The wire belt is driven by a 7½ h.p. motor through belt and counter-shaft to give the desired speed reduction. The driving pulley is a double-grooved cast-iron sheave 40 inches in diameter. A special device provides the desired tension. A weight of 800 to 1000 pounds was found necessary in these experiments. Orienting pulleys 28 inches in diameter are provided for conducting the wire from the driving mechanism to the sheaves at the ends of the cut in the quarry. The pulleys may be adjusted radially, and a ball-and-socket joint permits orientation to suit the position of the cut. At each end of the saw cut a steel I-beam standard is provided as support for the saw guide sheave. The lower sheaves which guide the wire as it enters and leaves the cut may be raised or lowered on the standards.

The wire saw when in operation passes from the standard at one end of the cut through the slate to the second standard, thence to the drive mechanism and back to the first standard. Sand and water are fed to the saw and drawn through the cut by it. The wire travels at the rate of 14.3 feet per second.

Sand is fed to the wire from V-shaped boxes it is carried into the cut by a small stream of water from rubber hose connected with a pipe line, and entering the upper end of the sand box. Three boxes were used in the tests conducted, one being placed as close as possible to the point where the wire enters the rock. It was found by experiment that the stream of water should not be reduced too greatly, it should occupy one-third to one-half the opening of a ¾ inch rubber hose. If insufficient water is supplied the sand rides on the wire while a larger stream carries it beneath the wire where the effective cutting takes place. A sharp silica sand free from pebbles is desirable. If pebbles are abundant they gradually fill the cut and make it difficult to supply sand to the wire.

Tufa Stone Out West

The Tufa Stone quarries of the Tufa Building Stone Company are located at Kirkland, Arizona, on Santa Fe lines, and extend over approximately one thousand acres of merchantable stone. The stone being in a solid formation without seems is channeled into blocks of any required dimension.

Tufa stone is a buff stone of volcanic ash with a binder of aluminum. The aluminum will run approximately thirteen per cent, by weight. Due to its origin, it may be submitted to over three thousand degrees Fahrenheit temperature. This Tufa stone does not readily absorb water and containing no trace of free alkali will permit a building faced with it to remain clean for a maximum period of years. The State Capitol of Arizona was erected, with a complete facing of this stone, over thirty years ago and is today in the same perfect condition as when erected. Tufa stone, unlike other stones of sedimentary formation, does not disintegrate upon exposure, but will harden with age.

The Tufa Building Stone Company has been manufacturing this stone in Los Angeles for the past two years and find that it is steadily growing in popularity. It is used for facings and trim for both building and residential work. As to the cost of manufacturing, they find that it cuts with the same speed as Indiana limestone. One decided advantage in handling this stone is the low cost of freight, its weight being from one hundred to one hundred ten pounds to the cubic foot in the rough.

The members of the company have made a thorough study of Tufa stone formations throughout the western states and have found this deposit to be the only one that could be quarried in a large commercial way. There are other and large deposits of Tufa stone in the west, but they are of a different nature and do not lay in solid formation.

NEWS OF EQUIPMENT MANUFACTURERS

New Thew Shovel

A new type of pull shovel or trench hoe has been put on the market by The Thew Shovel Company, which offers some unusual advantages for sewer and excavating work. It is called a Back Digger by the Thew Company because it is more than a trench machine, being very efficient in cellar work and other kinds of digging as well.

The primary difference between this and previous types is in the control of the dipper, which can be tilted by the operator to any angle desired, at any stage of the digging or dumping operation, and held in position or changed by the operator at will.

Instead of spilling the dipper load through the entire arc of the digging arm as with the stationary dipper type, this tilting dipper permits the operator to hold his load until he has spotted his dipper exactly where wanted over a wagon, truck or spoil pile, after which the dipper can be instantly dumped. When dumping close, much time is saved because it is unnecessary to swing the dipper to the extreme limit each time to completely empty it. When sticky material clings to the dipper the operator can shake the dipper to dislodge positively and completely all the unspilled remainder. The control of the dipper tooth angle at any position of the digging arm also provides digging advantages not possible with the stationary type of dipper.

The tilting dipper is also a great aid in back filling. The dipper can be pulled to the edge of the trench in a horizontal position pushing the dirt before it and can then be tilted to empty the dipper into the trench. The ability to hold dipper in any position wanted while back filling, permits cleaning up the entire spoil pile without gouging into the solid ground beneath it. This equipment can be attached to any Lorain-75 or Lorain-60 shovel now in the field. The change can be made very easily and quickly.

Special Steel Described

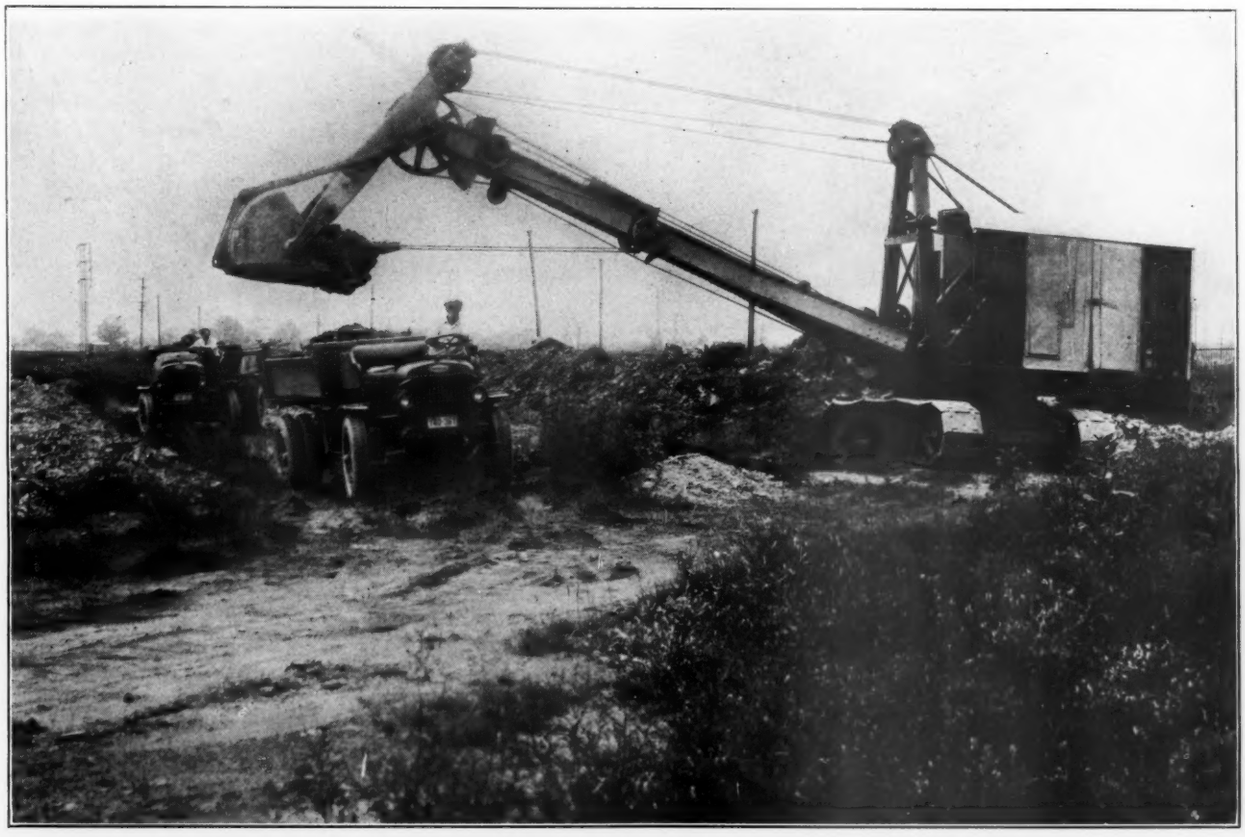
In a brochure recently put out by the Erie Steel Corporation this company describes comparative tests of their special "Serpent" Styrian rock drill steel. A new and exclusive heat treatment is claimed to give this steel the ability to resist breakage, resist the destructive effects of overheating in forging take a proper point hardness over a wide range of quenching temperatures and give a higher drilling efficiency. The brochure suggests compartive tests with other steels and gives illustrated directions for making such tests.

G. D. Cooper Joins Speeder

Glen D. Cooper, Electrical Engineer, for seventeen years associated with the electrical industry and for the past few years in charge of the public relations department of a large utility company has been appointed assistant sales manager of the Speeder Machinery Corporation, manufacturers of Speeder shovels, pull-shovels, cranes, draglines and skimmers. Mr. Cooper will have charge of the organization and development of the industrial field acting as assistant to T. M. Deal, Sales Manager.

New Zelnicker Bulletin

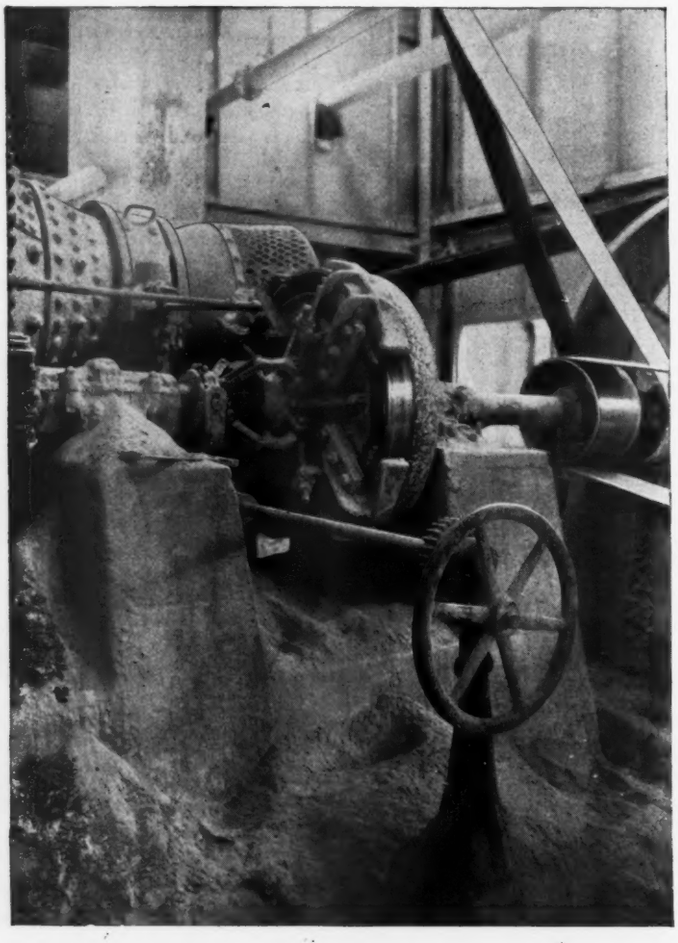
The latest Zelnickers bulletin offers a very extensive list of geared locomotives for standard gauge, 36 inch gauge, 42 inch gauge and 24 inch gauge. The bulletin also offers many other listings in second hand equipment including locomotive cranes, pumps, pipe, steel piling, deck girder, an 80,000 gallon steel tank on an 80 ft. tower, leather belt, boilers, spikes and other needs of the pit and quarry.



New Type of Pull Shovel

New Friction Clutch

Friction clutches in connection with the transmission of power are now employed in almost every industry. The convenience and economy resulting from the possibility of cutting off one or more machines, shafts, or entire sections of the shop without disturbing other running machinery are well-known factors in maintaining uninterrupted service, reducing the cost of production, and permitting flexibility in controlling operation.



New Hill Friction Clutch

The friction clutch manufactured by the Hill Clutch Company is shown in the illustrations. In this clutch, which is known as the Smith type, the same principle of action is retained that has been employed in the well-known standard type clutch manufactured by this company. A number of changes and improvements in design and construction have been made, however, in this latest design.

These clutches are built with three, four and six arms, according to their capacity. The accompanying illustration shows this new clutch in actual operation. The friction surfaces are wood against iron, which is a combination offering great frictional resistance, and the shoe area is exceptionally large. The coefficient of friction is the same at all points, owing to the heavy cast-iron jaws, rigid guides, and the balanced toggle connection from the cone to the jaws which positively releases as well as engages, the friction surfaces. All of the toggle mechanism is of steel castings or forgings with the single exception of the connection levers, which are of cast iron.

Another noteworthy feature in the design of this clutch is that any working part including the inside jaws, may be removed parallel to the shaft from the mechanism side. This can be done without disturbing the main spider casting or pulley, as bolted gib guides secure the inner and outer jaws to the spider. The entire clutch mechanism is open and accessible for adjustment and the removal of shoes when necessary. The clutch pulleys are mounted upon split removable sleeves babbitted or bronze lined as specified, which can readily be replaced without removing the pulley or clutch.

Another important advantage in this clutch is the self-centering feature. As all jaws fulcrum at a point equi-distant from the center of the shaft, they form a perfect centering or shaft aligning device without the necessity of troublesome shaft bushings. The clutches are built in either the solid or split types. In the split conconstrution the bolting lugs are so distributed as to offer the greatest resistance to the forces tending to part the clutch. These clutches are built in nineteen sizes, ranging in capacity from 9 h.p. to 1300 h.p. at 100 revolutions per minute.

Material Handling Units Discussed By Lakewood

The Lakewood Engineering Company have just issued a new catalog giving complete details of material handling in industrial plants, terminals, and warehouses through the use of storage battery tier-lift trucks. Besides the standard units there are a number of special types of trucks shown for meeting unique problems that arise in industrial handling.

The catalog is generously illustrated throughout showing methods of reducing costs in storage and interplant transportation. It is entitled "Storage Battery Tier-Life and Tractor," Bulletin Number 35*A.

Chain Belt Company Appoints New Superintendent

Luther H. Bosnian has been appointed Superintendent of the Park Street Plant of the Chain Belt Company, Milwaukee Manufacturers of REX Conveyors, Travelling Water Screens, Chain and Concrete Mixers. Mr. Bosnian is a graduate of the Sheffield Scientific School, Yale University and has been connected with the Chain Belt Company's Production Department for the past eight years. Previous to this he was with the Westinghouse Electric and Manufacturing Company and came to the Chain Belt Company in 1919 as a time study man.

Climax Appoints

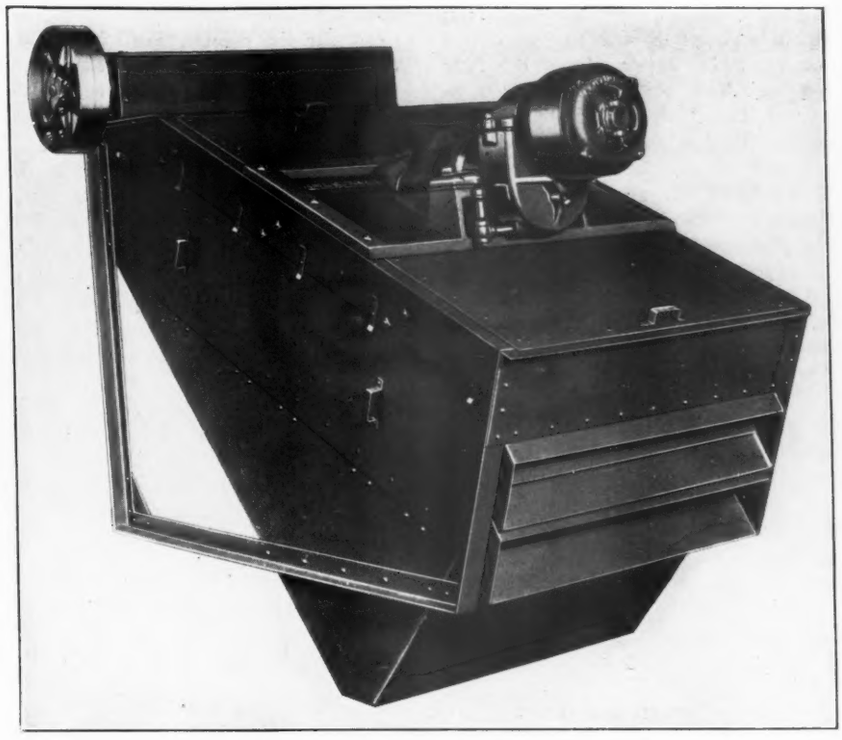
The Climax Engineering Company announces the appointment of John Reiner and Company, Inc., 309 Church St., New York City, N. Y., as Climax Service Representatives for the states of Connecticut, New York and New Jersey. John Reiner and Co., Inc., maintains a complete assortment of repair parts for all models of Climax engines and have available a corps of experienced service engineers so that users of Climax engines will be assured of reliable parts and labor service at all times. In addition, a selection of Climax engines and industrial power units are in stock for sale and prompt shipment into the many fields in which these engines are used.

A New Vibrating Screen

The Norwood Engineering Company has acquired the United States, Canadian and Mexican manufacturing and selling rights on the James Screen, a recently developed vibrating screen which offers many exceptional and interesting advantages. The James Screen was developed by U. S. James, mechanical and metallurgical engineer of Newark, New Jersey, and is based on a new and highly efficient principle of vibration.

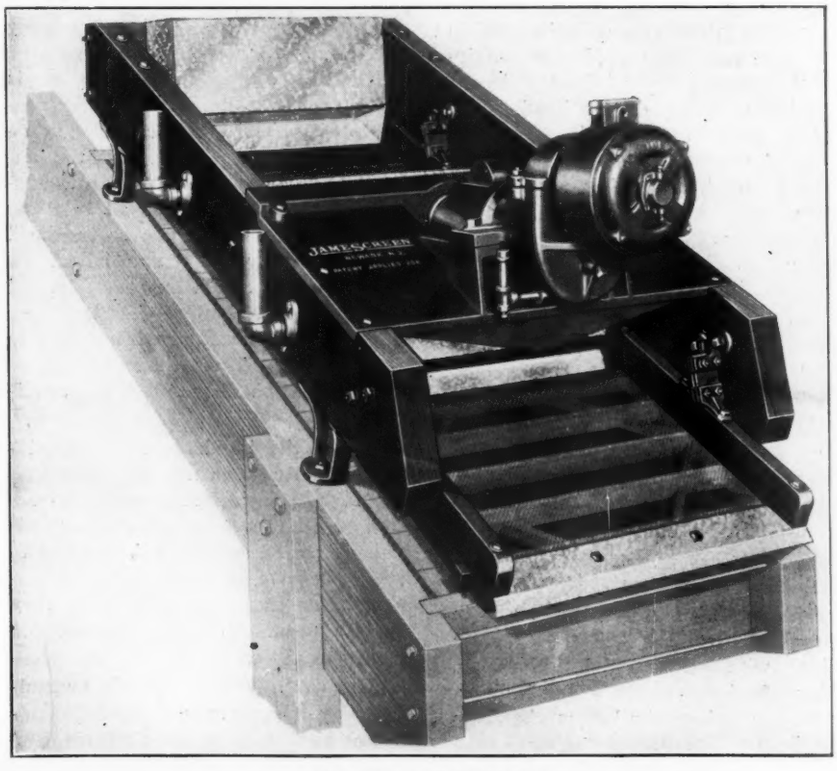
It has proven itself in many ways an excellent screen through its ability to handle tremendous loads of any screenable material, either wet or dry, and do an accurate, efficient and economical job of screening and sizing. Possibly Mr. James could not have made a better selection than the Norwood Engineering Company for the manufacture and sale of his screen, for the Norwood Company has been established for over forty years and has built up an international reputation for high quality and dependability. They are pioneers in many fields of mechanical development, their organization is composed of progressive engineers, and they have the plant and facilities for efficiently manufacturing the James Screens.

Plans are under way to establish at Florence, Mass., or in Boston a laboratory equipped with both the James wet and dry screens with different wire or cloth screen sections for testing and make screen analysis. This work at present is done by the James Ore Concentrator Company at their laboratories in Newark, New Jersey.



New Type of Dry Screen

Mr. James, who is well known in the mining field for his many developments in concentrating machinery, both in this country and abroad, originally designed and developed by James Screen for the sizing of ores. A new principle of vibration was necessary in order to give higher capacity and absolute freedom from blinding, sectional screens were developed to reduce the expense of replacement of an entire screen when worn in part only and washing trays were designed to disintegrate the accumulation of mud balls on wet screening. A brief study of the main features of the screen will show its advantages in the screening and sizing of sand and gravel, crushed stone, abrasive material and many other similar ones.



New Type of Wet Screen

One of the outstanding features of the James Screen is the vibrating mechanism, which is based on an entirely new principle. The present vibrator consists of only three moving parts; a gyrating ram weighing over thirty pounds operates against a heavy piston, which in turn transmits the shock through a small anvil to a wooden cross member connecting the hanger bars which carry the screen frame. This ram gyrates at three hundred revolutions per minute and each of its six chilled steel sockets collide with the hardened steel contact points of the piston, giving to this latter member eighteen hundred head-on collisions per minute. These repeated shocks transmitted to the screen in this manner do something more than force every possible ounce of material through the meshes, they keep the screen from blinding and give uniformity vibration over its entire surface. This is a distinct advantage over the shaking principle in many ways.

The vibrator is housed in a heavy

dust, dirt and waterproof cast iron casing and requires a change of oil but once in every three or four months. The screen frame is suspended by flexible vanadium steel hangers so that neither dust, grit nor moisture can possibly affect the free movement of the screens. The screen frames are built in sections, which are interchangeable every six square feet of screening surface may be removed and replaced under actual working conditions in less than two minutes. The saving on screen cloth is obvious as well as the saving in time.

When screening materials by the wet process, finer than 3/16 inches in diameter, auxiliary washing trays located every two feet across the screen area, serve to disintegrate the accumulation of mud balls and by the addition of a sufficient amount of wash water, the fine grains are forced through the meshes with great rapidity. This feature is entirely new and adds from 25 to 50 per cent to screening efficiency.

The James Screen operates with a one horse power motor, or from line shaft. Screens up to eighteen feet in length have been built and are operating satisfactorily with the same size motor, there being the same uniformity of vibration over the screening surface of a large screen as over a small one. The James Screen has an exceptinoally wide screening range and is adaptable for screening everything that is screenable. The Norwood Engineering Company builds both the James Wet and the James Dry Screens and special screens are designed where necessary to meet special requirements.

Dust Problems Discussed

The New Haven Sand Blast Company has recently issued a booklet describing and illustrating their dust collectors. This bulletin discusses the development of two general types of positive arrestors, one built up of parallel cloth screens having the material rigidly fastened on frames and discharging the accumulated dust by a rapping system; the other by using a number of cloth cylindrical bags usually rigidly fastened at the bottom and suspended from above, discharging the accumulated dust by vibration of the suspension point, or rapping the bags.

In filtering through cloth the friction loss has a definite relation to the ratio of cubic feet of air handled per square foot of cloth area, so that the first type having a number of screens set closely together, containing a large cloth area, had a decided advantage from the standpoint of space required and expense. However, for the discharging of dust accumulated in the pore of the cloth, which built up the friction resistance and in time unless cleaned, clogged the system, the cylindrical bag type, though limited in cloth area due to space, had a distinct advantage as the cloth bag could be shaken vigorously.

After several years development a distinctive New Haven arrestor has been devised, which embodies the best features of both the screen and bag type arrestors with a number of improvements over either. The added advantage is offered of being able to replace bag units in a few minutes, permitting the maintenance department to keep the arrestor at high efficiency continually throughout its life.

Use of Rotary Car Dumpers Explained in Detail

In a broadside just issued the Roberts and Schaeffer Company, of which the Car Dumper and Equipment Company is now a part, describe their rotary car dumper. These rotary car dumpers are arranged to fit any condition. Installations in various fields comprise every type of mine known—shaft, slope, drift and incline—as well as all conditions met in industrial plants.

Where it is desired to continue the use of old car equipment and gradually replace it with new, both old and new car equipment can be handled in the same car dumper. New car equipment can and should be the lower, greater capacity, longer-lived, dust-tight, more economical, solid-body cars. Any one of three types of drive may be used, depending upon conditions.

Pneumatic—comprising steam, hydraulic or pneumatic mechanism—is probably the most satisfactory of the three. One big advantage in favor of the use of the pneumatic drive is that it cleans the cars much better, particularly where any wet, fine or sticky material must be unloaded.

These car dumpers require less attention, are more nearly fool-proof, will operate at a higher capacity, and are particularly desirable for underground use where moisture and danger from dust explosions must be considered. They can be used in dumping cars coupled together in trips with three link hitchings. Where feeders, cagers, weigh baskets, gates or other similar mechanisms are in use, the one motor or source of power may operate all equipment.

In operation, the electric car dumper is, of course, the most simple; a pushbutton controls the entire operation, the operator being able to stop the car dumper in any position. The car dumper is automatically stopped, on completion of rotation, by limit switches, automatic locks and spring stops. The electric car dumper is equipped with all special car holding mechanisms and has special constructional advantages.

The gravity car dumper has exclusive features that are important to satisfactory operation and car handling. It can be made automatic in operation and control.

Probably the greatest advantage gained by the use of the rotary car dumper at strip pits and quarries is the solid-body car which can be used. The old side-dump car was very weakly constructed, being balanced on pedestals along the center of the car and being held in position by the light and easily injured dumping irons. The car had very little strength to withstand the impact of heavy blocks of material dropped by the shovel and the frequent impacts of the shovel itself during the loading operation. The dumping of the side-dump car, loaded with hard, heavy, blocky material, is very severe on the dumping mechanism and on the car body. As a result the maintenance charge on this class of equipment is very high.

In a solid-body car the box of the car is set right down on the trucks and is therefore rigidly supported and much more able to withstand abuse even though the tare weight of the car is considerably less than any other dump car of equal capacity.

The fact that the solid-body car is lower and can be more rigidly constructed makes it a much more satisfactory car to operate over the uneven temporary tracks found in quarries and strip pits. It will hold the rail much better and can be trammed at considerably higher speed than the sidedump car. There are several types of installation of rotary car dumpers in connection with strip pits and quarries. The most suitable type of installation depends upon conditions.

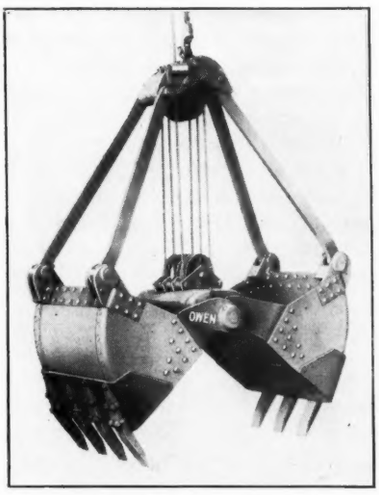
Where the breakage and degradation of material is not important and the topography permits the construction of a large storage bin at a nominal cost, cars may be left coupled to the locomotive during the dumping operation as they can be dumped very rapidly permitting the locomotive to return to the workings with the same trip of cars. Either a single or multiple car dumper may be used depending on the speed of dumping required and the capacity of the hopper.

Two New Owen Buckets

The Owen Bucket Company, well known manufacturers of clamshell buckets announce two new models, Type "M,'' a digging bucket, and Type "K," a rehandling bucket. Though both of these new types follow the general principles of design and construction of their other and earlier products, many details are improved upon. One very important result of these improvements is a reduction of upkeep cost to less than half of that necessary on the buckets they replace.

The Type "M" Owen Bucket is primarily a digger, designed for general contracting, excavating, and general purpose work. It is made in three models, namely, Type "M" Standard, Special and Narrow. The Narrow or Standard Type "M" Buckets when equipped with special grit-proof arm bracket construction are known as the Type "M" Special.

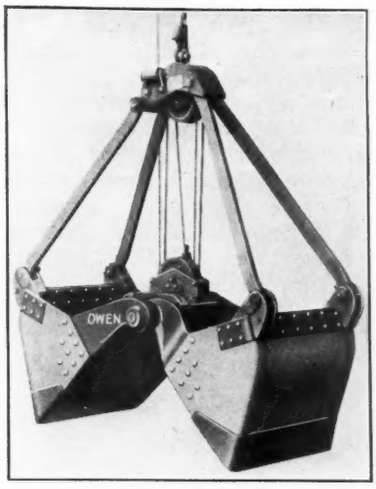
The rehandler known as the Type "K," is a lighter weight bucket of great strength and durability designed particularly for fast and efficient rehandling of wide range of materials. It is also made in three models, called



New Rehandling Bucket

the Standard Type "K," the Special, and the Hi-Speed. The Type "K" Hi-Speed, which is illustrated here, has a different shell with exceptionally sharp pitch to the bottom plates for rapid rehandling of loose materials. Both the Standard and Hi-Speed models can be furnished with special grit-proof lubricated bearings, and when so equipped are known as the Type "K" Special.

These two new types of buckets replace older types. The Type "M" Special takes the place of the Type "O." The Type "M" Standard and "Narrow" replace the Type "J" Standard and Narrow Digging Buckets. The Type "K" replaces the Type "J" Rehandling Bucket. The new types are in reality vastly improved Types "J" and "O" Buckets. In fact, so radical have been the changes that they amount to a complete new de-



New Digging Bucket

sign, and for the sake of clarity, it was deemed best to give them new identification type names. A few of the important improvements and changes incorporated in these new types are listed here as follows:

A new design of crosshead in one piece having seventeen less parts than on any previous type of Owen Bucket makes it possible to shorten the arms and provides for operation in reduced head room. The life of the closing cable has been increased by eliminating the possibility of the cable chafing on any part of the bucket. A distinctive feature of the new type is provision for complete protection and lubrication of the main or center shaft bearings which has double the bearing area of the older types. This feature prevents grit or fine material working in on the bearings and makes clean lubrication possible at all times.

The new buckets have extra heavy special alloy steel lips extending up the side plates past the wearing point instead of the flat cutting blades or plates formerly used. Actual tests have proven that these new lips are at least 200 per cent more durable than the old blades with greater ability to resist abrasion. The smooth contour of the inside of the shell, and the elimination of extra thickness of angles at the corners of the cutting edges insure deeper penetration and larger grab. The arm brackets have also been improved in that they are heavier, have greater leverage and more rivets are used to attach them to the bucket.

Foote Appoints

J. C. Rowett has recently been appointed factory district representative for Foote Bros. Gear & Machine Company, for the state of Minnesota and territory in northwestern Wisconsin.

N. R. Crawford Resigns

N. R. Crawford, for several years Director of Sales for the Industrial Works, Bay City, Michigan, has resigned, effective October first. No announcement has been made as to his future connection.

New Vibrating Screen

In two recent leaflets the Cottrell Engineering Company describes their new vibrating screens and also their pneumatic dry concentrator. The slugger screens are guaranteed to show no dead spots under any conditions, thus giving 100 per cent screening surface at all times and insuring maximum capacity.

With a system of adjustable eccentric and hammers the vibration can be altered to suit any particular material. Tightness of the screen cloth is not relied upon for vibration so a little stretching does not impair the efficiency. The fact that the screen is struck from below takes advantage of the inertia of the material passing over to force it through the mesh and screen cannot be overloaded.

Where frequent change of mesh is required, the desired cloths can be mounted on extra frames and an entire change in a triple deck machine can be made in five minutes. As the screen cloths alone are vibrated the minimum of power is used, approximately ½ h.p. being sufficient to operate the 3x8 foot machine.

Both head and eccentric shafts are mounted on Hyatt roller bearings which require a minimum of attention and are absolutely dust proof. A system of forced lubrication is fitted, and provided that this is fed with a good paraffine base grease once per week the life of the shafts and bearings is practically unlimited.

In the construction of these machines the company has departed entirely from the usual practice, in that they have applied the vibrations from the under side of the screen, thus obtaining the high efficiency by forcing the screen through the material. All clogging troubles are entirely eliminated and with the adjustments, any vibration which is desired can be obtained. For normal work a shaft speed of from 300 to 450 r.p.m. will suffice, but this can be increased to 700 r.p.m. with safety. The rocker shafts which carry the double hammers are of high grade square steel and are carried in heavy bearings fitted with grease cups. The steel arms operating these shafts are connected to the eccentric by means of reinforced rubber which is practically indestructible. The pneumatic dry concentrator is used for the separation of silica from pumica and like uses.

Universal Nozzle Described

A recent brochure of the Universal Nozzle Company gives some interesting details on the economies claimed for hydraulic stripping of overburden from stone, sand, gravel and other mineral deposits. This nozzle can be used for washing down sand or gravel banks, making cuts and fills in construction work, and for other uses.

The nozzle is universal in movement, enabling the operator to direct the stream in whatever direction he may desire. It does not have to be staked down or anchored in any way and is easily and safely operated by one man under any pressure.

The joints will neither leak nor lock under pressure and being built for rough usage, has no ground joints, no bolts or other obstructions in its waterways, and does not get out of repair, except that with constant use the turret joint may need repacking possibly once or twice a year, which takes but a few minutes. While it is usual when stripping to have a man in constant attendance, it is not necessary that he give it his entire attention, as the discharge pipe will remain in whatever position it is placed, without attenton.

No hose is required in its operation, as it is connected direct to the pipe line from the pump. However, hose or ball-and-socket joints can be used if desired. It does away with expensive hose, which has to be replaced every year or two, whereas the nozzle will last for years without even having to be repaired.

It requires no jacks or holders as does the ordinary hose pipe and a far greater amount of work can be done with it in the same length of time and at the same pressures. Being universal in movement, it has a greater effective range of delivery and greater "flexibility" and its ample waterways enable it to carry the volume right up to the point of discharge, saving loss of pressure by friction and enabling the operator to get better service out of the pump.

Because of the ease with which the stream may be deflected it is possible, after its action has loosened the overburden, to keep it in suspension and moving to the desired place without settling. By reason of this fact less water is needed to accomplish satisfactory results, and there is a corresponding saving of time and labor.

The nozzles are made of best red brass castings throughout, except the discharge pipe, which is of seamless brass tubing. The operating lever is of cold rolled steel and is adjustable as to length, and the turret joint is of the ballbearing, thrust type, which insures perfect ease of operation. The base, or stand, consists of a long-sweep, extra heavy cast iron elbow, to which is bolted a wood plank for support when used as a stripping nozzle. No stakes, jacks, or holders of any kind are required nor does it need any stabilizer of any kind, as the nozzle is always in perfect balance.

The style "A" with 4-inch inlet is the nozzle in most general use as it has waterways of sufficient capacity to furnish the volume to whatever size stream may be desired, from 1 inch up to and including 2 inches in diameter, and even larger where pump is of sufficient capacity.

Booklet Pictures Growth of McMyler Interstate

A recent booklet of the McMyler-Interstate Company builders of material handling equipment is significant in reflecting the tremendous strides taken in the last decade to handle the requirements of industry on the gigantic scale which modern handling equipment has made possible.

The McMyler-Interstate Company has had an important part in this progress. Being a consolidation in successive steps of the Eagle Iron Works, the McMyler Manufacturing Company, Kaltenbach and Griess and the Interstate Engineering Company, the McMyler Interstate Company has, as the result of years of development and experience, been able to produce some units of material handling equipment so gigantic as to stagger the imagination.

One of these units is the "League Island," a crane built for the United States Government, measuring 245 feet in height by 322 feet across, with a total weight of 3500 tons, capable of handling 500 tons at 115 foot radius and 50 tons at 190 foot radius, being a full revolving type crane making a complete revolution in 12 minutes. This crane—the largest crane in the world—is as high as a 20 story skyscraper and a real epoch in modern engineering history.

The company has also recently constructed two 120 ton car dumpers capable of handling 120 ton cars at the rate of 50 to 60 cars per hour. The company's plant occupies 43 acres in a suburb of Cleveland and their output includes steam crawler shovels, gas crawler shovels, electric crawler shovels, steam crawler cranes, gas crawler cranes, electric crawler cranes, steam locomotive cranes, gas locomotive cranes, electric locomotive cranes, barge fueling cranes, special and broad gauge cranes, stationary revolving cranes, dry dock cranes, pintle cranes, cantilever cranes, revolving gantry cranes, portal gantry cranes, semi-portal gantry cranes, roof type cargo cranes, trolley type gantry cranes, hammerhead cranes, jib boom cranes, ore handling bridges, drag line buckets, clam shell buckets, orange peel buckets, fogarty buckets, special large capacity buckets, stone skips, car haulage machines, elevating car dumpers, rolling car dumpers, rotary car dumpers, unloading towers, box car unloaders, skip hoists, gear blanks, structural steel (fabricated), sand bins, screening towers, structural hoppers, hammered and pressed forgings and R. R. switch stands.

Thew Adds Five New Men to Sales Organization

The Thew Shovel Company has just announced the appointment of five new men to their rapidly increasing sales organization. This company has met with such favorable success in the field with their popular Lorain-75A and Lorain-60A shovels, cranes, draglines and back diggers that the following men have been secured to cope with the tremendous increase of sales. Their names are undoubtedly familiar to many in the contracting field.

Mr. James S. Griffin, who has had valuable experience as a railroad contractor and in the sale of shovels and contractors equipment in New Mexico, Colorado and Wyoming will make his headquarters in Denver, Colorado, and cover the afore mentioned states.

Mr. E. L. Sparks will be in charge of sales in California. Mr. Sparks has had a wide experience in construction and sales work, for five years repreesnting one of the large steam shovel companies in the New England states and later being connected with the Ohio Locomotive Crane Company. More recently he has been District Manager in New York for the Williams Bucket Company.

Mr. J. L. Trout has been assigned to the Pennsylvania, Ohio and West Virginia territory, having had five years experience in the sale of power shovels, and many years experience as an operator.

Mr. M. B. Garber has been appointed Promotion Engineer, as his many years experience as Sales Manager with The Sanderson Cyclone Drill Company should prove valuable in solving problems of quarrys, and in the handling of crushed stone, sand and gravel, and other rock moving jobs. Mr. Garber is also active in the National Crushed Stone Association, having been Chairman of the Manufacturer's Division last year. Mr. P. A. McMillen has been attached to the Company's Chicago office as Sales Engineer.

New Wonder Hoist Book

In a new booklet just issued the Construction Machinery Company gives a very complete and well illustrated description of their line of "Wonder" hoists. The booklet gives detailed specifications and construction analysis of several types of single drum reversible, single drum non-reversible, two drum non-reversible, two drum reversible and three drum non-reversible hoists.

The three drum non-reversible hoist which is particularly adapted for operating clamshell or orange peel buckets, stiff leg derricks, dragline and excavating work, logging erection work, loading and unloading, contains only the highest standard of proved design, materials and workmanship. It is built for severe, continuous usage and contains many exclusive and refined features. This is made up into three drums and a boomswinger. All units are machined to templates thus insuring interchangeability. Operating levers, brakes and drum ratchet levers are conveniently grouped at rear of hoist. The boomswinger is supplied with hoist or can be attached later. The screw thrust drum engagement combined with a positive patented screw release. This hoist is furnished without or with electric motor; also with 30 h.p., 45 h.p., 55 h.p., or 60 h.p. four-cylinder engines.

The skids are heavy section I-beams, the lower flange being bent up at ends and welded to web. Heavy clevises are provided for anchoring and sledding. The skids are rigidly held in parallel position by spacers and diagonal braces.

The side frames are cast in the company's foundry from close grain cupola mixed semi-steel and sections are held as uniform in design as possible to prevent shrink strains. The wall is solid and reinforced with deep transverse ribs. The hoist may be altered in the field from a single to a double or triple drum with or without boom swinger, by simply bolting units together. The frames are identical and are machined on three sides and drilled to templates. Bearings are long and lined with highest grade of babbitt.

The drums are cast of semi-steel and bronze bushed. The barrel is machined and flanges flared to prevent rubbing of the rope. A fair-lead slot equipped with two heavy clamp screws receives the rope end, thus avoiding sharp bends. Friction contact is of double 4 inch face 15 degree cone type, lined with high grade asbestos weatherproof lining. In addition to a positive release there is the customary bridled compression spring insuring a very smooth follow up. The shrouded steel ratchet is fitted over a shoulder and held by six heavy cap screws. One end of the drum hub is circumferentially grooved to receive the positive release flange which projects from the thrust screw lever head.

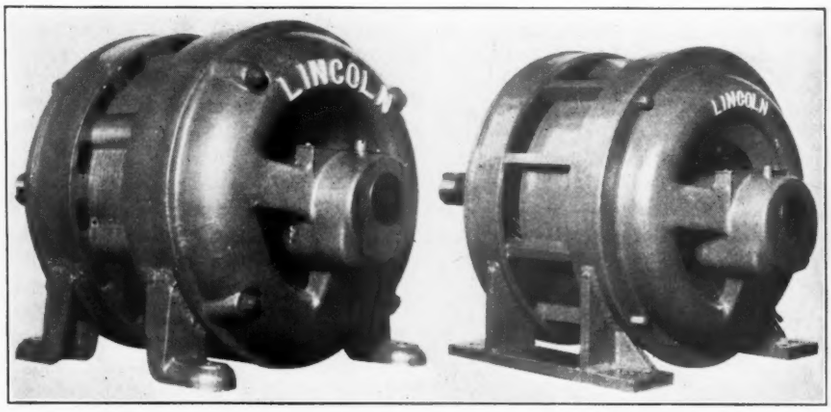
The patented thrust screw is of a unique, advanced and thoroughly proven design. There are no hardened discs, no hardened point thrust pin, no oil baths to take care of and no intense, high thrust pressure at one point nor is there any section removed from the drum shaft to make room for the thrust key and screw end. The thrust screw is made from phospher bronze. The threads are one inch circular pitch with quadruple lead, insuring a fast axial movement with the very minimum amount of thrust pressure per square inch. Another beneficial feature is that instead of the thrust pin resting within the shaft, thus allowing only a small fractional part of an inch thrust surface, this external bronze thrust forms the very bearing for the shaft which is absolutely self-aligning and has several square inches of thrust area. The friction is overcome by high grade ball bearings. All the thrust is concentrated on one frame bearing, thus allowing a free floating drum shaft on the other end. All the wear adjustment can be taken up with a castellated S. A. E. nut on the end of shaft. The thrust lever head is held around the thrust screw by clamp friction and can be adjusted to any desired position in a minute's time.

The brakes are 21 inches diameter by 4 inches wide of high grade weather-proof asbestos and copper rivetted to band. All gears are cut 2½ diameter pitch steel above 35 h.p. All pinions are forged steel 4 inches face. The guards are made from heavy plate, very easily removed and lubrication is Alemite throughout. The single drum hoist has thrust lever and brakebeam on the right side of the rope. Two and three drum with or without swinging gear have all the levers, brakes and pawl levers grouped back of the power plant where operator can have full straight ahead view of the work and reach every operation without a move.

Welded Steel Motor Frames

Recent patents issued from the United States Patent Office include welded steel motor frames in which welded steel construction has replaced castings. Patents 1,629,877 and 1,629,876 were issued to James F. Lincoln and assigned to The Lincoln Electric Company.

As shown in the accompanying illustrations, the construction is an assembly of hot rolled steel parts welded into the equivalent of a casting. The claims allowed for the method of construction cover its use only to dynamo electric machines. According to the statements of The Lincoln Electric Company engineers, it is claimed that the welded steel method of construction gives a practically unbreakable frame, lighter weight and better ventilation. Steel is six times as strong and two and one half times as stiff, therefore, less weight is obtained. Steel also costs only about one third as much per pound so that materially less production cost is secured.



Welded Steel Motor Frames

New Lo Hed Representatives

The Lo-Hed Hoist Division of the American Engineering Company announces the appointment of direct factory representatives in Pittsburgh and Cleveland for the sale of its Lo-Hed mono-rail electric hoists.

The Pittsburgh office, whose territory will include Western Pennsylvania, West Virginia and counties along the Eastern border of Ohio, is located in the Oliver Building with Mr. D. A. Polhemus in charge and Mr. John Kaiser assisting. Mr. W. C. Minier will direct sales in Northern Ohio, except for territory surrounding Toledo, with offices at 2195 Bellfield Avenue, Cleveland.

Du Pont Magazine Issues Anniversary Number

In connection with the 125th anniversary of the founding of the explosives manufacturing business of E. I. du Pont de Nemours & Co., the Du Pont Magazine appears as an Anniversary Number, greatly enlarged in size and containing many illustrations. Numerous special articles describe the development of the company from its inception in 1802, when Eleuthere Irenee du Pont de Nemours, a young Frenchman, began the making of gunpowder in mills he erected on the banks of the Brandywine Creek, near Wilmington, Del. Step by step the growth of the du Pont Company is traced from its small beginning up to its present status as one of the world's largest diversified chemical manufacturing industries.

Of particular interest to users of explosives for industrial purposes are the highly illuminating articles dealing with the early manufacture of black powder and its uses, and the subsequent perfection of high explosives. In each case the author is well qualified to write authoritatively and interestingly because of long connection with the branch of the du Pont business about which he writes.

"Resume of Black Powder History" is the title of an article by E. H. Ford, Director of the Black Powder Manufacturing Division of the du Pont Company. Briefly sketching what is known of the origin and the earliest uses of black powder Mr. Ford proceeds to describe the requirements of powder from the quality standpoint and to give something of the early history of the du Pont Company. In closing, Mr. Ford writes: "Whatever may be the reader's attitude of mind as to the importance of black powder among the many diversified products of the du Pont Company, he must always remember that it was upon the firm foundation of black powder that this great industrial structure was reared."

High explosives is the subject about which J. Thompson Brown writes. Mr. Brown is the General Manager of the High Explosives Department of the du Pont Company. "Of all the factors that have contributed to modern progress there is none that has played a more important part than explosives," the writer asserts, "and of these the most important, the most widely used, and the most adaptable is the high explosive, dynamite."

After briefly referring to the beginning of the manufacture of dynamite, Mr. Brown says: "It was practically in the infancy of the industry that Lammot du Pont established in 1880 at Repauno, on the Delaware River, the dynamite factory that is now the largest in the world. From that day to this the du Pont Company has been the leader in the high explosives industry, contributing the most to the art of the manufacture of explosives and their adaptation to the varied uses demanded by the rapid changes of modern civilization."

Mr. Brown's reference to the development of low-freezing dynamites and the perfection of permissible explosives are among the high spots in an altogether valuable contribution to knowledge of American leadership in the explosives industry.

A two-page historical map, in colors, is another feature of the Du Pont Magazine Anniversary Number which adds to the permanent value of the unusually attractive special issue of the publication. Few, perhaps, other than the well-read student of history, realize the comparatively small territorial extent of the United States in the year 1802 as indicated by this map. By means of pictures and text the story of the early development of the Republic is told.

"Old Black Powder Days," by J. W. Macklem, a veteran employe of the du Pont Company, and "Forty-five Years Ago," by George H. Kerr, whose connection with the company began in 1882, are articles written in a reminiscent mood and contain much of interest to readers whose memories extend back to the time when the du Pont Company was a family affair concerned almost solely with the making of black powder.

Other contributions show the tremendous growth of the company during recent years and its expansion in the chemical manufacturing field through the relationship of basic raw materials to the great number of manufactures now marketed under the du Pont brand.

Cranes and Trolleys Find Many Uses

H. D. Conkey and Company have recently issued a very handsomely illustrated booklet printed in three colors which describes their various types of cranes and trolley. The Conco trolleys are designed for a great variety of uses where material handling is necessary. The side plates are rolled steel, drilled and reamed for the fitting of axles. All rivets are hot driven by power.

The flexibility of the trolley is attained by the use of a specially designed load shaft bracket and a hexagon load shaft which equalies the load on each of the four wheels regardless of track irregularity. Wheels are of large diameter with machine crowned face treads set at right angles to the bearing surface of the track assuring perfect rolling motion and minimizing wear on wheels and track.

By means of washers and cotter pin connections the adjustment to four sizes of I-Beams is standardly effected. Special adjustments to run on angles or channels back to back or on other sized I-Beams can be made to order. Hyatt roller bearings are standard equipment on these trolleys and hardened inner and outer bearing surfaces are provided to eliminate wear and reduce friction. All trolleys are built in both plain and geared types.

This company specializes on the lighter capacities of cranes. On all top running Conco cranes the end truck channels extend beyond the truck wheels and are rigidly fastened together with steel separators, thus keeping the trucks rigid and true regardless of the overstrain they may be subjected to. On all underhung cranes the end trucks are tied together by a structural steel yoke to prevent spreading.

Travel rails are secured to the girders by hook bolts or fastened with strong steel clips. Hook bolts are used in cases where the rails may want to be adjusted and often trued up. Clip plates give a positive and firm connection eliminating the tendency for the rail to slide. The girders are coped out to receive the end trucks and the connection is made by means of clip angles and gusset plates in such a way as to resist any twisting tendency. A stronger, more rigid connection is made in this way than the standard practice requires.

Large extra strong steel plate rail stops are provided at each end of the crane girders to prevent over run of the trolley. Structural materials conform to standard specifications of the American Society of Testing Materials for Structural Steel for Bridges. Workmanship is in accord with the Manufacturers' Standard Specifications.

All rivets are hot driven by power, assuring a secure set of the rivet and proper capping. When driven hot by power the rivet makes a solid connection. Wherever bolts are used, lock washers are placed to prevent the loosening up that is often caused by vibration. All parts are painted inside and out with two coats to prevent the setting in of rust. All parts are painted before assembling to make sure that every inch of steel work is properly covered.

Dump Bodies and Hoists Featured in Bulletin

In a recently issued broadside the Heil Company describes and illustrates a hydraulically operated twin cylinder hoist and also several types of dump bodies for application to motor trucks.

The Heil hydro hoist is made for application on any make or model of motor truck from 1½ to 7½ tons capacity. The cylinders are first bored, then reamed, and finally honed with the same care and precision that is used in making fine motor car and truck engines and the hoist has a minimum of wearing parts with every wearing part floating in oil. Each part is oversized and the hoists are designed to handle much heavier loads than the rated capacity of the truck for which recommended.

The Heil steel dump body Number 11 is made with square corners, straight sides, and front end crowned. It has full length runboards which serve as mudguards, and also protect the tailgate operating device. There is an angle iron across the front head end and top of tailgate and tailgate is double acting equipped with chain spreader device.

The Heil light construction body model L-11 is built for use with Number 3 Heil Hydro hoist on light duty speed trucks. These light construction bodies weigh from 300 to 500 lbs. less than standard construction. This reduction in weight is obtained by lightening the subframe, the tailgate operating mechanism and tailgate casting. Provision is made for extra sides to increase the body capacity for light materials. There is a sliding coal door and bagging hooks in the tailgate.

In the Model 10 Heil steel dump body the straight sides and square corners appeal to large fleet-owning contractors and trucking men who want an all-around serviceable dump body. The body is fitted with a spreader device which regulates the opening of the tailgate for gravel and asphalt spreading.

Heil dump body model Number 51 is a "3-in-1" combination body which can very easily be changed into a stake and platform job. Then with the tailgate extended level with the floor of the body, the dump truck readily becomes available for express service. The other combination body models are known as the "2-in-1" and the "4-in-1."

There are many other models of Heil steel dump bodies, especially designed for various types of hauling requirements, such as garbage bodies, steel wood lined excavating bodies, ice bodies, and other designs with combinations of round corners and flared sides.

New Power Hoist

A new broadside just published by the Dake Engine Company describes and illustrates a new convertible gasoline or electric power hoist. The base frames are of one-piece unit construction. The side stands are cast solid to the base. This insures greater strength and rigidity as well as perfect alignment of the intermediate shaft and drum shaft bearings. The gasoline engine or the electric motor is mounted on the single drum hoist base unit so that the hoist is self-contained. The single drum base frame is machined and drilled so that the base frame unit for the second drum can be attached and bolted solid to it. The second drum base frame unit is also machined and drilled for attaching the boom swinger unit. The holes for bolting units together are drilled under our interchangeable parts system so that any purchaser of the single drum hoisting engine may at any time convert it to a two-drum hoist, with or without boom swinger, by securing the extra units wanted.

The drum shafts and intermediate shaft are equipped with Timken tapered roller bearings. The drums are friction type and made of cast iron with extra large phosphor bronze bushings. All drugs are equipped with replaceable double shrouded ratchets and forged steel pawls.

In addition to the feature of being able to convert the single drum hoist to double drum and vice versa, the base plate is arranged so that either a standard hoist duty motor or a gasoline engine may be used. Thus the purchaser of a gasoline driven hoist may change to electric drive if desired, by the purchase of the motor and driving pinion, and replacing the gasoline engine with electric motor, no machine work being required for making the change. He saves the purchase of an extra hoist and with minimum expense may use the same hoist with the power most suitable for any job.

All hoist parts are made in jigs and fixtures on the duplicate part system, and are rigidly inspected, guaranteeing interchangeable parts for all repairs.

The Continental Red Seal Industrial power unit, Model P-20, is used for gasoline operation. The engines are equipped with radiator, vertical tube gravity feed carburetor, air cleaner, high tension impulse magneto and switch, force feed lubrication with oil gauge and indicator, spark plugs gasoline tank, housing and muffler, also close regulating automatic governor for speed control. The slewing attachment for bullwheel derricks is simple, strong, compact and efficient. It operates independently of the drums and has single lever control.

Standard types of motors developed for hoisting duty are furnished. The horsepower ratings are based upon one-half hour continuous work with fifty-five degrees centigrade rise in temperature. Alternating current motors are of the slip ring, variable speed, induction type. Direct current motors are enclosed type, series wound, protected from dust and moisture. Drum type controllers operated by a single handle.

New Gear Reduction Unit

A new heavy duty worm gear speed reducer, with correct tooth form, has been recently put on the market by the D. C. James Manufacturing Company. This modern reducer has undergone most exacting and comprehensive tests in the company's shops. Worms and gears are run in on a special relieving machine to assure the smooth, frictionless action of the worm and gear. It is able to meet most severe conditions, and can be applied where worm gear reducers were formerly impractical.

A large oil cooling chamber prevents over-heating. When the worm is at the top of unit sight feed oil cups are used for furnishing a high grade of oil to the roller bearings on the worm shafts. The oil level cock, fitted into the side of the housing, prevents over-oiling—a condition as serious as under-oiling. An oil drain plug in the lower part of the housing facilitates cleaning and draining of gear oil.

Phosphor bronze gears, S.A.E. 3140 chrome nickel steel worms Timken and Norma Hoffman Roller Bearings and interchangeable bushings are used to provide the utmost in satisfactory service and long life.

The housings are made of high grade gray iron, designed for maximum oil cooling space, braced on the outside for strength, and carefully cleaned before assembling the parts.

All parts are made of the best material, with an ample safety factor, Gear shafts are .40 carbon steel, ground to absolute accuracy, and made oversize to withstand starting and overload strains. A lock nut and lock pin, which allow for easy adjustment, hold the thrust bearing in proper position on the worm shaft. A large heat radiating and oil cooling space in the housing keeps the oil at a low, even temperature, and prevents overheating. The easily repacked stuffing gland on the worm shaft prevents oil leakage. It can be repacked without disturbing the shaft.

A Quick Lift Hoist

The American Engineering Company announces the "Quick-Lift," an all steel, quarter ton electric hoist. This is a high speed hoist with pressed steel frame, chrome-manganese steel in gears and shafts, ball bearings, non-spinning hoisting rope, oil bath, lubrication, push button control and upper and lower limit switches. All working parts are fully enclosed. The hoist weighs 200 pounds and is made in two types—plain trolley and hook suspension. The plain trolley type requires 16-inch headroom and the hook suspension type 18-inch.

Greenwood Joins Foote

Mr. H. V. Greenwood, formerly sales manager of the Baldwin Chain Co., joined the sales organization of Foote Bros. Gear and Machine Company, as Michigan district representative. Mr. Greenwood makes his headquarters in Chicago, but covers the State of Michigan with the exception of the Detroit and Grand Rapids territory.

Westinghouse Promotes

Promotion by which R. L. Wilson, Works Manager of the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Company, becomes Assistant to Vice President and General Manager, and J. M. Hipple, Manager of the Company's Motor Engineering Department, is elevated to the position of Works Manager, have been announced by F. A. Merrick, Vice President and General Manager.

Mr. Wilson has been an active worker in the electrical industry since 1893 when he joined the Westinghouse Company, following his graduation from Rose Polytechnic Institute, where he received his degree of Bachelor of Science in Mechanical Engineering, and a year's post graduate course at John Hopkins University in Electrical Engineering. After a few months as an apprentice, he worked as a draftsman. From 1895 to 1898 he was an inspector in the shop and from 1898 to 1901 he served as road engineer and then for two years as district engineer in New York, where he handled the Interborough Rapid Transit Electrification and other big jobs. He was then recalled to East Pittsburgh as Superintendent of Construction, holding this position until 1906 when he was appointed Superintendent of Railway Construction.

In the three years in which he held this latter position, he handled the electrification of the New York, New Haven & Hartford Railroad from New York to Stamford, which at that time was the biggest electrification project the world had witnessed. He also handled the electrification of the St. Clair Tunnel.

Following these electrifications, he was recalled to East Pittsburgh and took up the work of Superintendent of the Railway Department in the factory. He later became Assistant General Superintendent in which position he had a great deal to do with employment and welfare work in addition to his work in the Railway Department. He was appointed Works Manager of the East Pittsburgh Works, which position he held until his present appointment, in 1920.

Mr. Hipple was born in Jefferson, Ohio, and was graduated from the Ohio State University in 1898 with the degree of Mechanical Engineer of Electrical Engineering. Upon his graduation, he entered the employ of the Westinghouse Company and for one year was engaged in the Testing Department. He then was assigned to the Engineering Department where for one year he was engaged in work in designing transformers. From 1900 to 1911, he worked on direct current motor design and in 1911 was made Manager of the Motor Engineering Department, in which capacity he had charge of the designing for all industrial apparatus, including A-C motors, controllers, etc. This position he held until his present appointment.

Mr. Hipple has had important work for the Westinghouse Company other than that of Manager of the Motor Engineering Department. This work had to do with the Educational Committee of the Company's Engineering Department, of which he is a member.

Electric Controlling Units Featured in Bulletins

Several new bulletins of the Allen-Bradley Company, for incorporation in their loose-leaf catalog, have been recently issued. These bulletins are numbered 410, 644, 660, 702, 704, 709 and 760 and describe controlling rheostats, semi-automatic resistance starter, slip-ring motor starter, alternating current contactor, alternating current reversing switch, across-the-line starting switch and an automatic slip-ring motor starter, respectively.

Of special interest to pit and quarry operators is the automatic slip-ring motor starter. This device, known as Allen-Bradley type J-3064 automatic compression resistance starter makes it possible to automatically start and bring to speed the slip-ring induction motors used on crushers, conveyors, line shafting and other machinery.

Important features of this starter are gradual acceleration made possible by the use of Bradley unit resistors in the rotor circuit, reduction of current inrush to exast starting current required for load, thus reducing the jolt on the power lines, overload relays, low voltage protection and several other features which make it a very efficient device on the job.

Alexander Milburn Opens Boston Office

The Alexander Milburn Company, manufacturers of welding and cutting apparatus, portable carbide lights, oil burners and preheaters, and paint and lacquer spraying equipment has organized an office in Boston to be known as The Alexander Milburn Sales Company, Wiggin Terminals Building, 50 Terminal street, Boston, Mass.

This office is under the supervision of Messrs. M. B. Crouse and G. B. Malone, both experienced executives in welding and cutting equipment. This office will handle the sale and distribution of Milburn equipment throughout the New England states in a highly specialized manner.

New Fin Furnace Catalog

The new edition of the Combustion Engineering Corporation Fin Furnace Catalog is just off the press. The text has been completely revised, and numerous illustrations, including setting drawings and plant layouts have been added. These drawings exemplify the most modern trends in boiler and furnace design.

Recent Patents

1,641,777. Roll grizzly, Ray C. Newhouse, Wauwatosa, Wis., assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis.

1,641,862. Mining-machine truck. Charles B. Officer, Winnetka, Ill., assignor to Sullivan Machinery Corporation, Claremont, N. H.

1,642,122. Division-head propelling screen. William F. McMahon, Riverside, Cal.

1,642,139. Pulverizer. Charles E. Brainard, Chicago, Ill.

1,642,189. Dipper for excavating machinery. William M. Bager, Werner Lehman, and Frederick C. Ruhloff, South Milwaukee, Wis.

1,642,191. Dipper-front construction. William M. Bager Werner Lehman, and Frederick C. Ruhloff, South Milwaukee, Wis.

1,642,213. Construction of concrete piles or foundation elements. Abram R. Neelands and Georges Damry, Doncaster, England.

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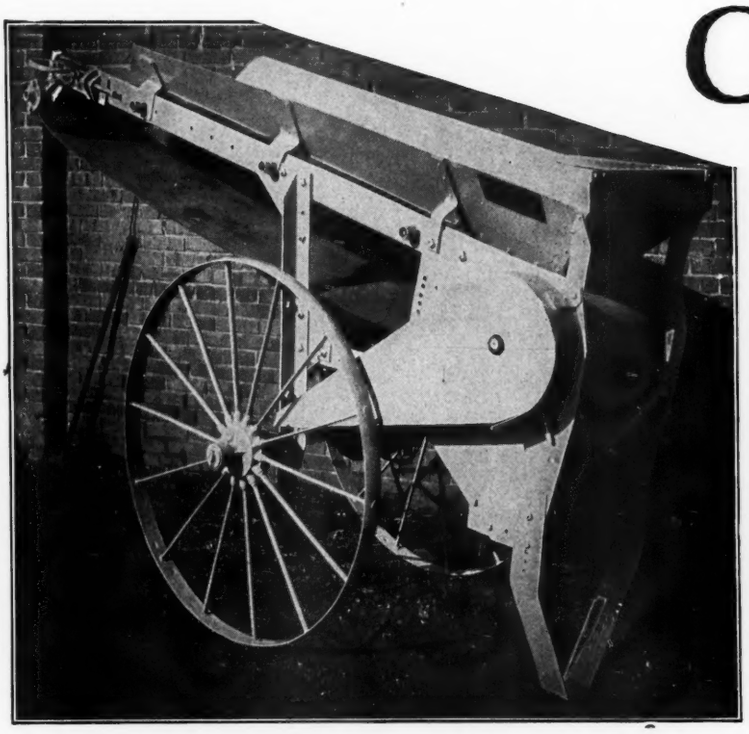

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Here is a machine, requiring only the part time of one man, which will faithfully and steadily load your cars for you, preventing delays, increasing capacity and reducing overhead.

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You will be amazed at the flexibility, adaptability and economy of this machine. It is proving its value wherever it is used.

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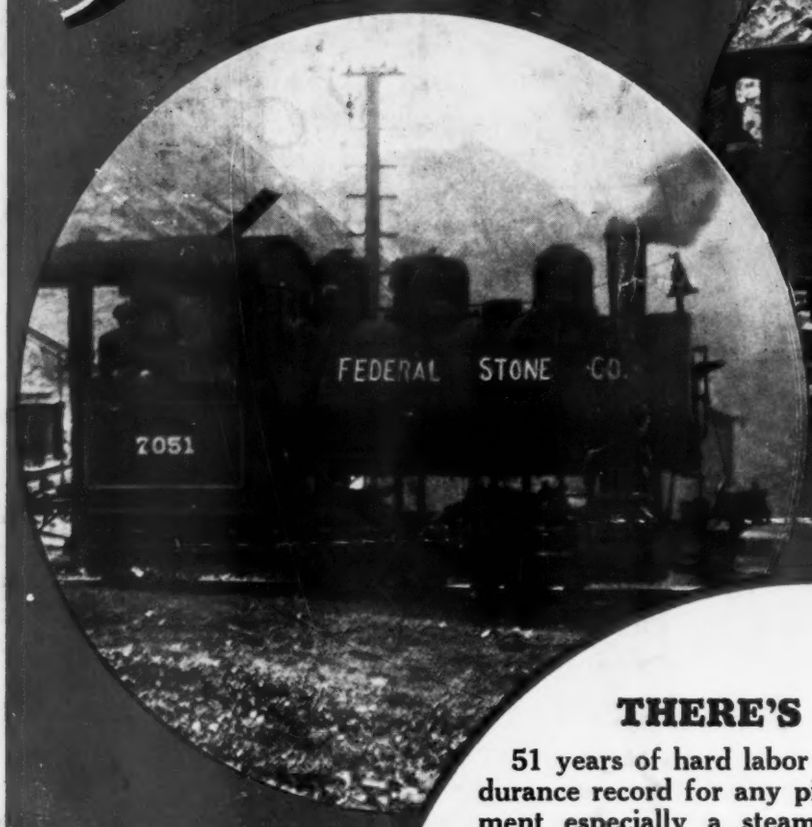

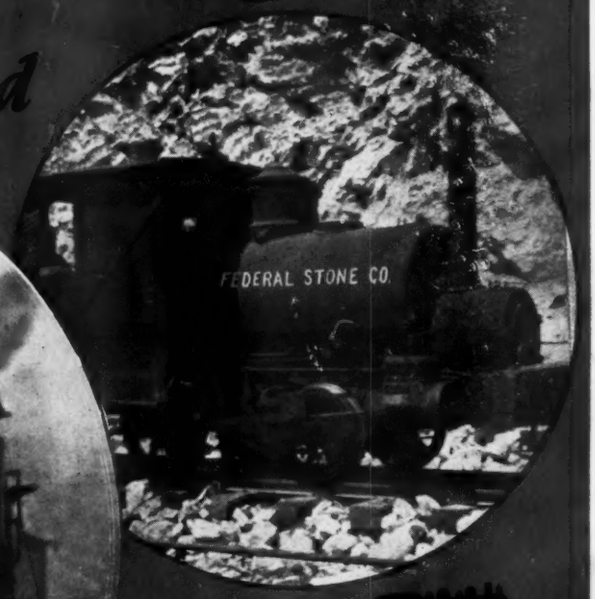

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